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Power from Test Beds

Utilising Waste Energy

ALTHOUGH absorption dynamometers of the water-brake type are giving excellent service in the testing of internal-combustion engines, they have the drawback—objectionable at any time, but something more than that now in view of the coal shortage—that they waste the power developed by the engines on the test stands in uselessly heating water with obvious attendant disadvantages. This waste energy, less only a moderate proportion for losses, can be put to gainful purpose if it be converted to electricity.

An excellent example of a regenerative testing installation (both automatic and hand-operated) is described in this issue. In this an average of 300 kWh is salvaged from each engine tested and, with the aid of the infinitely variable control provided by the ubiquitous Ward Leonard system, is used as motive power in the factory. It is of some importance that the energy tester does not have to give attention to his electric dynamometer, the motor-generators being started by the maintenance electrician and kept running while tests are on.

In Aero Engine Works

A still wider field for regeneration is to be found in aircraft-engine works where the number and individual capacity of the units tested are much greater than in the case of internal-combustion engines built for ordinary duties. The chief need is, briefly, to convert energy from a source of varying speed to electric power at the right frequency and voltage.

There is nothing new in the principle, but it was once thought to be inapplicable to engines of capacities as great as those used for propelling modern aircraft. Nevertheless, from recent articles in *Aircraft Production* (quoted on a later page) it appears that recent developments have made electric braking entirely feasible. There are in course of manufacture in this country equipments that regenerate over the whole range of power and speed. In this they show an advantage in comparison with most of the schemes in use in the United States which do not regenerate at the lower speeds or measure torque.

Disposal of the Energy

The electricity thus produced can be used for running-in other engines, for supplementing the public supply to the works or for providing some degree of stand-by. Should there be a surplus over the works' requirements, which we believe does not often happen, it could be delivered to the outside network, provided, of course, that local conditions allowed of a feed back.

While rises in voltage can be effectually curbed through adjustment of the field current of the synchronous generator (even during acceleration tests when the engine output may vary from zero to maximum within about four seconds), there may in some instances be difficulties in the way of absorbing any unpredictable surplus in public supply systems. In such cases the installation of relay-controlled thermal-storage apparatus to furnish hot water for the factory might be worth consideration.

As the production of war-planes con-

tinues to gather momentum, so the value of energy regeneration for saving coal increases. Some idea of this value is given by our contemporary, although the instance quoted is not necessarily typical. In addition, the peaks on public generating stations would correspondingly be relieved. There are consequently good reasons for welcoming the decision by the Ministry of Aircraft Production, subsequent to the publication of these articles by our contemporary, that all further engine-testing plants installed shall be regenerative. Our present information is that the incorporation of the Ward-Leonard system is to be preferred to the use of a slip coupling.

New Year Honours

FROM the electrical point of view the " high lights " of the New Year Honours List are the knighthoods conferred upon Mr. Johnstone Wright, chief engineer of the Central Electricity Board, and Mr. G. H. Nelson, chairman and managing director of the English Electric Co., Ltd., worthy representatives of the two most important branches of the industry—supply and manufacturing. Other industrialists who receive recognition (M.B.E.) include Mr. A. Parkinson (Crompton Parkinson) and Mr. A. L. Chilcot (Ferranti). Two prominent municipal men receive the C.B.E. in the persons of Mr. P. J. Robinson, city electrical engineer, Liverpool, and Mr. R. S. Pilcher, general manager of Manchester Corporation Transport Dept. Research is recognised by the award of the O.B.E. to Dr. C. Dannatt (Metropolitan-Vickers) and the M.B.E. to Mr. E. C. S. Megaw (G.E.C.)

Cable Protection

SHORTAGE of steel has entailed some relaxation of the requirements of Regulation 2 of the electrical code for factories. It would appear from the increasing number of accidents that have resulted from lack of mechanical protection for cables and conductors that the risks attached to this often unavoidable departure from sound practice are not always fully appreciated. Wiring should, of course, be preferably installed out of reach but, even where this is possible, some form of mechanical protection, adequately earthed, is still needed when wiring is exposed near overhead machinery, or where repairs or painting, such as to the roof, may have to be done. Cleated systems are said to be proving satisfactory, but care is needed where heavy or lengthy articles are handled.

Control of Fuel

THE general effect of the provisions of the new Control of Fuel (No. 3) Order, 1942, were briefly stated in our last issue. The need for some explanation of the Order is made apparent by a study of its contents. For instance, Article 8 (2) (iii) says :—

> " Any direction under the article may require any person carrying on any undertaking to employ, for the purpose of preventing the waste of fuel and the uneconomical use and consumption thereof, upon such work and for such periods as may be specified in the direction such persons or such class or description of persons or such number of persons or such number of persons of such class or description as may be so specified ; and the direction may specify the manner in which the persons so employed are to perform their duty."

Prolonged study will reveal that this means that undertakings may be required to appoint fuel economy officers whose duties may be specified.

Magnesium Grinding

WITH a view to securing reasonable safety from explosion in the grinding of magnesium powder, two main precautions are recommended by the Electrical Branch of the Factory Department. The first is a system of interlocks, preferably with a time-lag device, to prevent access to the mill after it has been stopped until most of the concentrated dust cloud has settled. The other is the use of electrical apparatus within dust-proof or, preferably, flame-proof enclosures with flanged joints treated with grease so as to exclude dust. As the risk referred to appears to be inherent in the process, such safeguards seem to be necessary in all cases.

Paper Salvage

It is to be hoped that among electrical concerns' New Year resolutions is one to keep a watchful eye upon the salvage and disposal of waste paper. The need for this in munitions production grows with the accelerated output and so there must be no slackening. Advice and assistance are obtainable from the Electrical Industry Waste Paper Recovery Committee, 2, Savoy Hill, W.C.2.

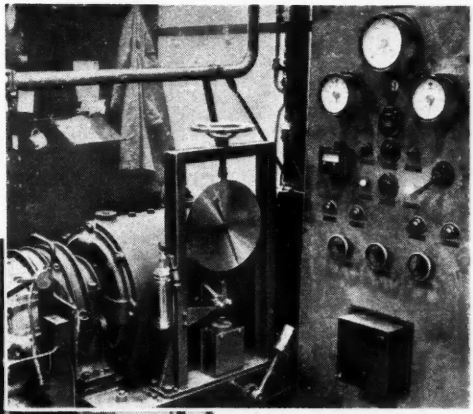
Regenerative Engine Testing

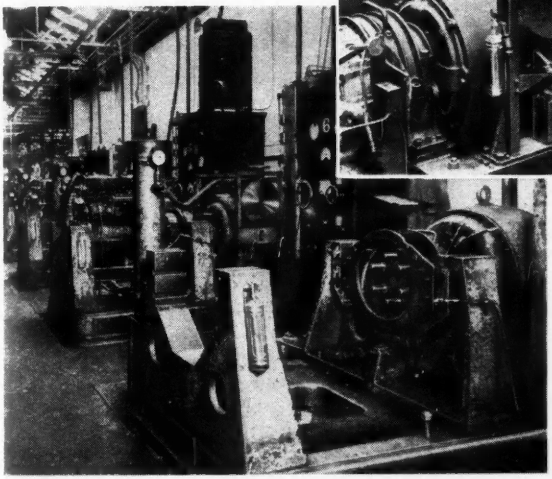
Advancement Indicated by an Installation with Various Types of Machines

THE outstanding impression which we received from a recent visit to a comprehensive regenerative testing installation for internal-combustion engines relates to the advancement which has been made in the technique of this valuable method of engine testing, which has a special significance to-day. During a single test of a common size and type of engine 300 kWh is returned to the supply system, after allowing for all losses, and in the light of such figures as this and the present conditions, particularly with regard to fuel, it seems impossible to justify the use of any form of non-electric dynamometer for engine testing.

We saw automatic, semi-automatic and hand-operated dynamometers all on practically continuous service, and while it will not be necessary to describe all the equipments fully it will be useful, after outlining the testing routine and dealing with the latest sets, to refer to those features of the other main types which indicate the advance which has been made. But to refresh the memory a word first about the principle involved.

In all cases in this installation the dynamometer is a standard DC shunt-wound machine (dynamo or motor) housed on the swinging-frame principle, the frame being connected so as to operate against a Salter spring balance for torque-indication purposes. It is connected to the engine through a flexible belt coupling, and according to the test requirements the dynamometer, running as a motor, may drive the engine, or, running as a generator and supplying power to the supply system, may be driven by the engine.

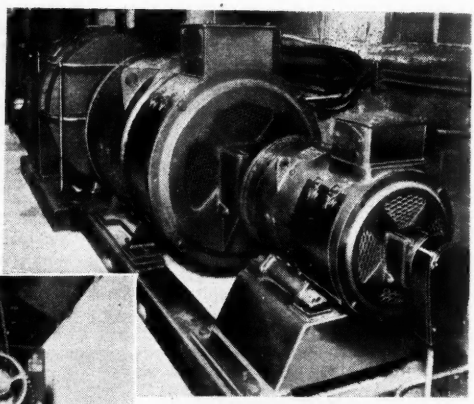




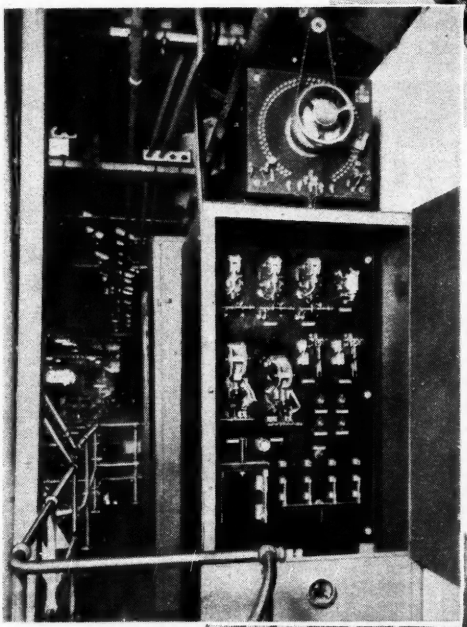
Above : A cubicle alongside the test stand with the push-buttons and instruments; the scale is brought back to the balance point by tension. Left : Automatic, semi-automatic and hand-operation dynamometers on practically continuous service ; note flexible coupling

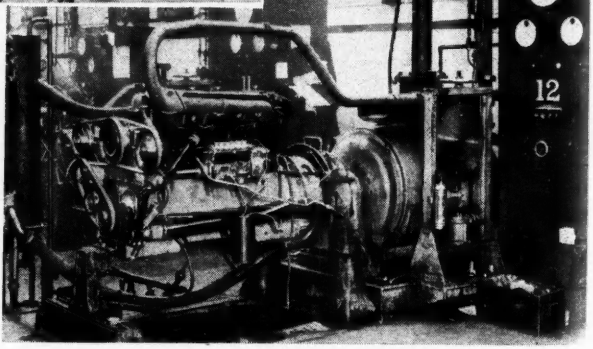
Briefly, the testing routine is as follows. A particular complete engine from the assembly shops is mounted on the test stand and coupled up to the dynamometer by which it is first driven for 1½ hours for running-in purposes, during which time the speed is gradually increased from, say, 600 to 1,200 RPM. It is then run on fuel to develop about 30 HP, the speed being worked up to about 1,500 RPM. This time, of course, the dynamometer runs as a generator and supplies useful electric power. After another run at 40 HP and up to about

1,700 RPM the cylinder heads are tightened down and the timing is checked. There are subsequent runs with full load at different speeds up to 1,900 RPM before the engine is taken away to be stripped for examination. After reassembly the engine is subjected to a final test consisting of a warming-up run and load runs at different speeds from 800 to 1,900 RPM. At all stages during these tests water-temperature, fuel-consumption and torque readings are taken and the HP is calculated from the speed and torque figures.



Each pair of automatic dynamometers is operated in conjunction with a Ward-Leonard controlled m.g. set



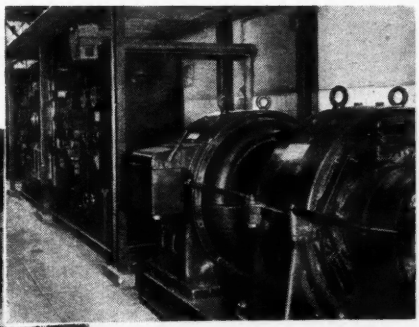


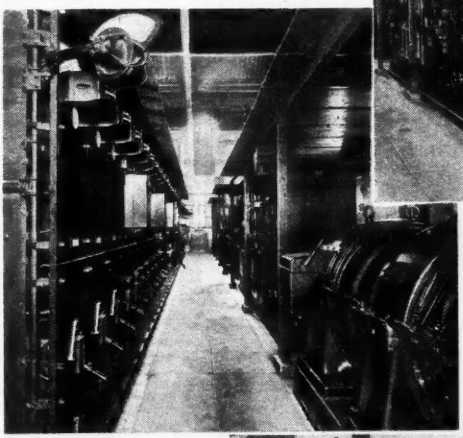
Above : The main Ward-Leonard set control cubicles house the contactors, relays and the motor-operated field rheostat.
Right : At all stages of the tests water-temperature, fuel-consumption and torque readings are taken (automatic set)

When there is no engine on the stand and the dynamometer has no power on it the torque scale is disconnected and the point at which the dynamometer balances is marked against a fixed pointer. When the dynamometer is on load the scale is brought back to this point at every speed and load variation by means of tension applied by a hand wheel, and at this setting the correct reading is given on the scale. The later English Electric sets which are being installed will be fitted with Ashworth, Ross springless balance giving a direct reading in torque. This will obviate the above adjustments and calculations.

The most recently installed

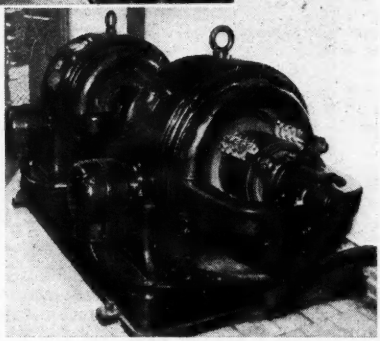
dynamometers are automatic equipments, each pair being run in conjunction with a motor-generator set with two generators, one for each dynamometer, operated on the Ward-Leonard system of control. Obviously, then, we must consider the two dynamometers and the m.g. set, together with their control gear, as one complete unit. To refer to the latest equipment, the dynamometers are swinging - frame, naturally - ventilated, separately excited machines, complete with spring balances. Ward-Leonard control gives speed control up to 3,000 RPM, and field weakening of the dynamometer gives a further range from 3,000 to 3,600 RPM with constant HP, while an emergency overspeed of 4,000 RPM may be obtained by field weakening of the dynamometer. The ratings of the equipment for working as motors are 80 per cent. of the above input figures on a continuous-running basis.





Ordinary m.g. sets are a common source of supply for the non-automatic dynamometers and have their own switchboard (above). All the sets are fed from the main factory distribution board (left)

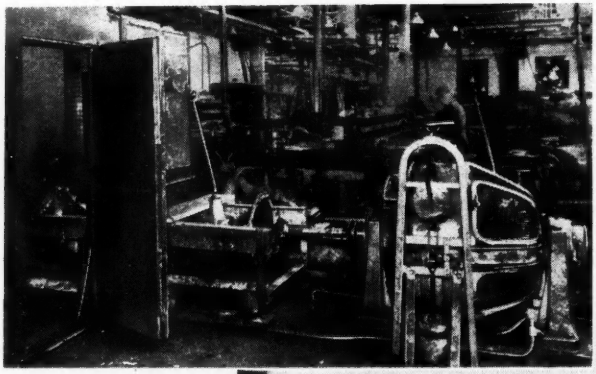
The m.g. set has a 635-HP, 1,000-RPM, 415-V, three - phase salient-pole synchronous motor in tandem with two 440-A, 440-V separately excited standard protected DC generators and two 6·5-kW, 115-V exciters. One of these exciters serves the synchronous motor and the other the DC generators and the dynamometers. The pull-out torque of the synchronous motor is 1·4 times the full-load torque. The exciter for the generators and the dynamometers is, of course, the Ward-Leonard control unit. When an engine is on load the dynamometer runs as a generator which supplies the corresponding generator on the Ward-Leonard set, thus running this generator as a motor which, in turn, drives the synchronous motor as a generator. When, however, the engine is motored for running-in purposes the sequence is as follows : the 635-HP synchronous motor drives the directly-coupled generators as generators which, in turn, supply the dynamometer which, operating as a motor, drives the engine.



Thenon-automatic m.g. sets operate with a balancer to give a 3-wire DC supply

These various changes are effected automatically by means of electrical speed and voltage regulation. If the two generators of the Ward-Leonard set operate under opposite conditions *i.e.*, one as a motor and one as a generator, and with the input and output loads equal, then, ignoring machine losses, the synchronous motor simply floats on the balanced equipment. The whole point about the Ward-Leonard control, of course, is the very much wider and more flexible speed range obtainable. In the event of the speed becoming too high a centrifugal switch on the

dynamometer will cut out the equipment. The control equipment for the complete set is arranged in two sections, namely, a cubicle situated alongside the test stand and provided with the necessary push-buttons and indicating instruments only, and the main Ward-Leonard set control cubicles on a platform erected over the m.g. set which houses the contactors, relays and the field rheostat for the dynamometer, the last surmounting the appropriate cubicle. The rheostat is a 100-way potentiometer, complete with a pilot motor, and other essential components of each control cubicle are high-speed regulation, speed-varying and warning-signal contactors, a double-pole field contactor for the generator and dynamometer and a stiffness indicator contactor which is set at a figure given by the designer at which the engine should run light. This indicator keeps open a relay in the control circuit until the setting is reached by the engine.

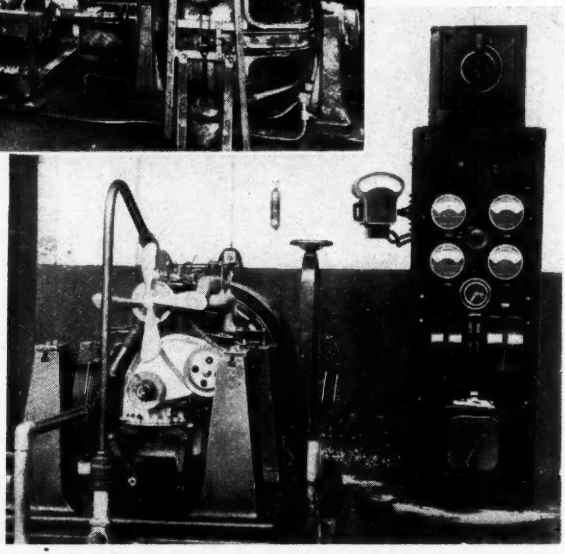


Two dynamometers in tandem with, and on either side of, the gearing within a sound-proof cabinet

The starting equipment for the motor-generator set is housed separately in a sheet-steel cubicle with two oil circuit-breakers, one for the auto-transformer by which the synchronous motor is run up to speed and which is also housed in the cubicle, and one for the final direct-on switching.

The equipment just described, *i.e.*, the two dynamometers and the Ward-Leonard motor-geneator set, is a complete English Electric equipment. A Fuller Electrical set is similar, except that the two starting switches for the synchronous motor are connected in the stator windings for starting and running and the excitation is also picked up by these. There is only one exciter on the m.g. set for serving the synchronous motor and the generators and the dynamometers.

Engaged on similar work there are a number of semi-automatic and hand-operated dynamometers. These are 110-HP units and they all have a speed range of from 700 to 2,000 RPM. They operate individually and have a common supply from ordinary AC–DC motor-generator sets. All the control gear of each of these dynamometers is incorporated in the control cubicle by the test stand, and while in the case of the semi-automatic machines the field resistance is in the cabinet with the contactors, the hand-operated starting resistance for each of the manually controlled dynamometers is mounted on top of the corresponding control cubicle. For the semi-automatic machines all starting is push-button controlled and load variation is controlled by hand-operated field rheostat ;



The older dynamometers have become inadequate for modern engines

the voltage changing is also performed manually.

The voltage changing applies to both the semi-automatic and the hand-operated dynamometers, two voltages of 460 and 230 being employed to obtain a suitably wide speed range. At the point of voltage change a flat line is introduced into the machine output curve and this results in considerable difficulties when a test is taken at about this point of the characteristic. One of the principal advantages of the Ward-Leonard equipments is the removal of this flat portion of the curve.

We saw a number of older dynamometers which have become obsolete for normal engine testing merely because their smaller capacity is inadequate to cope with the larger engines of to-day. Some of them, however, have been put to good purpose in connection with the testing of components in preference to employing water dynamometers which must, of course, be considered very wasteful in the light of the installation described. One example of such adaptation is a gear-testing set-up. This employs two dynamometers running in tandem with, and on either side of, the gearing to be tested. The gearing can thus be loaded from either side with the dynamometer running as a motor, but the dynamometer on the other side absorbs the power and converts it into electrical energy.

The gearing is housed in a sound-proof cabinet in which it is tested for noise, and it is loaded up to a point equivalent to service conditions. For another adaptation scheme there are two dynamometers coupled in tandem to load against an engine for running-in purposes.

The m.g. sets which supply the semi-automatic and hand-controlled dynamometers are housed in the main factory distribution room, and in one instance a 300-kVA, 415-V, 1,000-RPM, synchronous motor is coupled to a 250-kW, 460-V, DC generator and an exciter. The synchronous motors of all the m.g. sets serve a useful purpose by way of power-factor correction ; but, of course, the essential reason for their existence lies in their use as generators when the sequence of operation of the dynamometers is in that direction. For the dual-voltage supply for the speed variation of the hand-operated and semi-automatic dynamometers the corresponding m.g. sets are operated in conjunction with a balancer to give a three-wire DC supply.

All the m.g. sets are started up by the factory maintenance electrician and they are run continuously during test periods, so that for the dynamometer-operation purposes they are merely regarded as the source of supply and the testing engineer is not concerned with them beyond that aspect. All the m.g. sets are supplied from the main factory distribution board on which is a 500-A circuit-breaker supplying each ordinary m.g. set, *via* a separate switchboard for these equipments, and a 750-A circuit-breaker which serves each Ward-Leonard set direct.

Power Saving on Test Beds

Fuel Economy in Aircraft Engine Works

EARLY last year attention was drawn by *Aircraft Production* to the large amount of power (possibly 500,000 HP) that was being wasted by the use of absorption dynamometers of the water-brake type in the testing of aircraft. Representations were made to the Minister of Aircraft Production, who has now announced that all new engine test plants shall be designed to turn waste power to useful purposes instead of dissipating it in heating water, as with the other type.

Some aircraft-engine manufacturers already have in hand schemes to meet this requirement, and the August issue of our contemporary gave technical particulars of the regenerative equipment of the torque-reaction type made by the English Electric Co. This equipment consists of a swinging-frame dynamometer electrically connected to a DC motor which is coupled to a synchronous generator. The latter, which has sometimes to function as a motor, has its field system supported on trunnion bearings and is connected to the electricity supply system. For converting engine power at any speed to electric power at constant frequency the Ward-Leonard system is employed.

Reaction against the field system exactly equals the shaft torque and a springless torque weighing mechanism can be coupled to the field system to measure torque at the radius of action. Machine losses do not show on the torque indication. As the torque reaction is transmitted through magnetic flux, there is no wear, so the inherent accuracy of the machine is permanent.

When the engine is being driven, *e.g.*, for running in, the DC motor is excited to give a voltage in excess of that of the dynamometer, which functions as a motor, while the DC motor acts as a generator and the AC generator as a motor. When the engine is delivering power it drives the dynamometer at a higher speed so that its voltage exceeds that of the DC motor, causing the AC machine to feed back to the supply system. By controlling the fields of the dynamometer

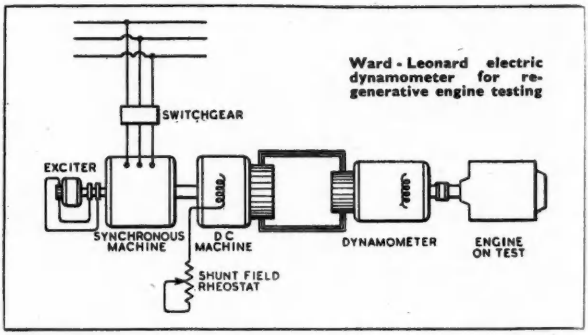
and motor, either automatically or manually, any load at any speed is obtainable and over 80 per cent. of the engine output can be converted to electrical energy.

Speed-load characteristics similar to those of the airscrew can be obtained automatically and the load can be controlled to the 2·8 power of the speed, if required. Acceleration and deceleration tests can, therefore, be made under approximate flight conditions without adjustment of the controls. Compensation for the effective inertia of the dynamometer can be introduced. Acceleration tests can thus be made to simulate airscrew tests over a range of sizes having WR^2 of different values.

Analysis of a specific test showed that the total engine output over the period was 9,084 HPhr. for which 870 gal. of fuel was used. At an efficiency of 83 per cent. this is equivalent to 5,620 kWh, to generate which in a power station would have required approximately 3½ tons of coal.

Many regenerative plants have been installed in the United States, one concern having installed 77 equipments. Many of these, however, our contemporary states, regenerate at the higher speeds only, and do not measure torque.

In its November issue *Aircraft Production* gives further particulars of United States practice. In the G.E.C. scheme, the synchronous machine is connected to the engine through a slipping coupling. It is run up to speed with the coupling de-energised and then synchronised, after which the coupling is energised in order to start the engine and bring it up to a speed above that of the synchronous machine. The synchronous machine, through the action of the slipping coupling, feeds back to the mains, the amount of load being controlled by the engine throttle and the degree to which the coupling is energised.



In the new Ford factory, which builds Pratt & Whitney aircraft engines, a standard Westinghouse 1,250-kVA, 720-RPM synchronous generator is connected to each engine through a hydraulic coupling and delivers power to the AC busbars. Each engine during its test is said to produce about 2,000 kWh, and the aggregate of the electrical energy thus generated on the test beds is more than half of that used in the works.

Proposed Transport Association Merger

FOR some time discussions have been proceeding between the Omnibus Owners' Association and the Public Service Transport Association regarding the possibility of closer working or the co-ordination of their activities. On many occasions since the outbreak of the war the organisations have taken joint action, and in the course of the various negotiations it seemed clear that the two Associations had interests which were in the main identical.

The Councils of the two Associations have now generally approved a scheme for the merger of the two organisations in a new body which it is proposed to call the Public Transport Association, Incorporated. The scheme provides for the winding-up of both the existing Associations and extraordinary meetings are to be called to secure the approval of members.

The new Association will have corporate members, extra-ordinary members, associate members, overseas members, and honorary members. The corporate members will include company and municipal operators of road passenger transport undertakings, and manufacturing and trading concerns interested in the industry. The extraordinary membership will be open to such undertakings as the London Passenger Transport Board. Associate membership will be open to individuals concerned with or interested in the road passenger transport industry, and overseas membership will be open to road passenger transport concerns operating outside the United Kingdom. The corporate members will comprise undertakings of all sizes, and trolley vehicle and tramcar undertakings will be catered for equally with the purely motor omnibus undertakings.

It is believed that the association will be the largest organisation of its kind in the United Kingdom, for it is expected that it will be representative of at least some 30,000 passenger vehicles, in addition to the fleet of the London Passenger Transport Board.

Single-Phase Motors

Various Methods of Starting

By S. F. Philpott, M.I.E.E.

UNLIKE two- and three-phase machines, the stator windings of which when excited from a polyphase supply produce a rotating magnetic field of constant value, a single-phase stator winding produces a field which only pulsates from zero to maximum; it does not rotate and so cannot of itself cause the rotor to revolve. If, however, the rotor is rotated by external means, it will continue to turn.

The problem of making the single-phase motor self-starting thus resolves itself into means of giving the rotor an initial rotation to bring it up to full speed, exerting sufficient torque to overcome the resistance of the load to which the motor is coupled. The starting torque required varies from something less than full load to several times normal full-load value, depending on the application.

Various methods of starting have been devised which have given rise to a number of types of single-phase motors, such as the shaded-pole, split-phase, capacitor, and repulsion-induction. In all of these, except the last, a second phase winding (energised from the main supply) is introduced, thus making the motor approximate to a two-phase motor.

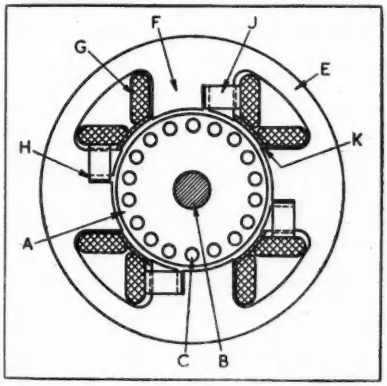


Fig. 1.—Construction of four-pole shaded-pole motor

The nearer the approach to true two-phase conditions the better is the starting performance, but the cost of the motor increases proportionately. Thus the starting-torque requirements of the driven machine are the main determining factors in the selection of the most suitable and economic type.

Most types of motor revert automatically to single-phase operation as soon as starting has been effected, but, in some, two-phase operation is maintained.

Mechanical starting, *i.e.*, giving initial rotation by external means, is rarely used, but this possibility should not be overlooked where conditions make the method convenient. Both the auxiliary second-phase winding and its associated automatic switchgear are then obviated, giving a cheaper motor.

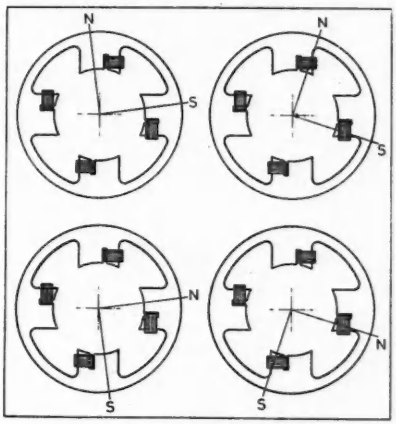


Fig. 2.—Rotating field of shaded-pole motor

Shaded-pole Starting

The shaded-pole method of starting has the merits of extreme simplicity and cheapness, but the motor is so inefficient and its starting torque so poor that its use is confined to such small power applications as ventilating fans, gramophone motors and advertising devices, where efficiency is of little importance and starting against full-load torque is not called for. Its efficiency is usually in the neighbourhood of 10 per cent. and starting torque is usually only 40 to 50 per cent. of full-load torque. Starting current is of the order of 150 to 200 per cent. of full-load current.

The rotor follows usual induction-motor practice. The four-pole example of the shaded-pole motor shown in fig. 1 is built up of laminations A pressed on shaft B and has a number of copper bars C sweated into

copper end rings at each end of the iron laminations. Sometimes the rotor winding is of cast aluminium instead of copper.

The stator is built up of laminations E riveted together, having salient poles F, each having a coil G. The coils are connected in series to produce poles of alternate polarity. Each pole has a slot H, and inserted in this slot and surrounding about 30 per cent. of the pole, is a copper loop J and between each pair of poles is an iron bridge piece K. The effect of the shading coils is to retard the

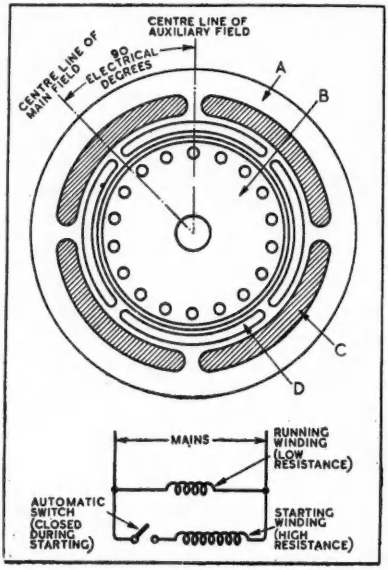


Fig. 3.—Split-phase-start motor

growth of the flux in those portions of the poles that they surround, due to induction of circulating current within them. Thus the magnetic flux in the shaded portion of the pole does not reach its maximum until the flux in the unshaded portion has passed its maximum and is beginning to recede. Taking into account the change of polarity, a rotating field is obtained (see fig. 2) which cuts the rotor conductors. The poor performance of this type of motor is due to the shading coils remaining in circuit all the time the motor is running, the fields set up by the shaded and unshaded portions of the pole not being 90 deg. apart, and the use of salient poles.

Split-phase Starting

The most popular way of starting single-phase induction motors larger than those to which shaded-pole starting is applicable is by the split-phase method, in which the stator is slotted and the winding spread over a number of slots per pole as with polyphase motors. The motor has two windings, the main or running winding, which has low resistance and relatively high reactance, and the starting or auxiliary winding, which has a high ratio of resistance to reactance. The windings are displaced at 90 electrical deg. apart and are connected in parallel. An automatic switch cuts the starting winding out of circuit when the motor has run up to speed.

In fig. 3, A is the stator, B the rotor, C the running winding and D the starting winding. The effect of the difference in resistance and reactance of the two windings is to set up two magnetic fields having considerable difference in time phase and thus produce conditions approaching those of a two-phase rotating field. As the running winding has some resistance and the starting winding likewise has some reactance, true two-phase conditions are by no means obtained, and so the starting performance is inferior to that of a polyphase motor.

High Starting Current

The starting torque is of the order of 150 to 200 per cent. full load, compared with 200 to 300 per cent. for a three-phase fractional HP motor. Starting current is high (five to seven times full load as against 400 to 600 per cent. for the three-phase type), and for this reason split-phase motors are not much used in sizes above about ½ HP.

A noticeable reduction in starting torque occurs after the motor has started to rotate. The effective maximum starting torque is thus that indicated at the lowest point of the dip (fig. 4) and not that at the actual start. Typical applications of split-phase motors are washing machines, light drills and other machine tools and miscellaneous applications not calling for excessive starting torque.

As the starting winding is only in circuit for the brief time during which the rotor attains full speed, it has usually an extremely short time rating (about 5 sec.). Overloading of the motor, which may cause the speed to remain below the operating speed of the automatic switch, will cause the starting winding to burn out.

Various types of switch are used for disconnecting the starting winding, such as the "Twinob" switch (A.P. Lundberg & Sons, Ltd.). This is a large tumbler switch having double contacts and two dollies. Both contacts are closed on switching on, but when the switch is released one dolly returns to the off position, under the influence of a spring, and so open-circuits the starting winding.

The more usual method is to use an automatic switch built as an integral part of the motor. There are two types—the mechanical, in which the contacts are opened by centrifugal action when the rotor attains full speed,

and the magnetic, in which an electric magnet in the main circuit holds the switch contacts closed so long as the relatively heavy starting current flows. When full speed is attained and the current drops, the pull of the electric magnet is insufficient to hold the contact points together. The majority of motors on the market to-day have centrifugal switches. A typical example is illustrated in fig. 6 (G.E.C.). In this the weights A are thrown outwards due to centrifugal force against the pull of the springs C and in so doing push the sliding bush B forward along the shaft, making contact with the spring D. This causes contacts E to separate so opening the circuit of the starting winding.

Capacitor-start Motors

While the split-phase motor has the two windings displaced 90 deg. in space, the phase difference of the currents in the two windings is less than that. It can be brought to 90 deg. by a condenser in series with the starting winding, giving what is known as the capacitor-start motor. The improvement in performance, due to the introduction of the condenser, is very marked. The starting torque ranges from 300 to 400 per cent. of the full-load torque for 400 to 500 per cent. of the full-load current.

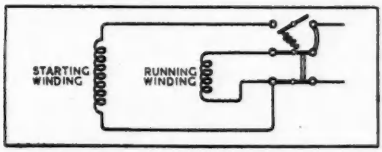


Fig. 5.—"Twinob" starting switch for single-phase motors. (A. P. Lundberg & Sons)

The addition of the condenser makes the capacitor-start motor more expensive than the split-phase type, which it otherwise resembles in size and construction. A fairly large value of condenser is called for, for example 30 μF in a 1/6 HP, 230-V, 50-cycle motor, and the electrolytic type is generally employed as the cost and size of a solid-dielectric condenser of this capacity generally prevent its use.

The unsuitability of the electrolytic condenser for continuous operation is no detriment, as it is in use only for the short starting time, the starting winding circuit being opened automatically as with the split-phase motor. The capacitor-start motor is very largely used in refrigerators.

In the split-phase and capacitor-start motors the starting winding is disconnected on reaching full speed. For some applications it is desirable to leave both windings in circuit. Two condensers are then provided, one a high-value short-time-rated electrolytic condenser for starting and a low-value continuously rated solid-dielectric type for running.

At starting, both condensers are in parallel, the electrolytic condenser being cut out by the automatic switch when full speed has been attained. This type of motor has the same starting

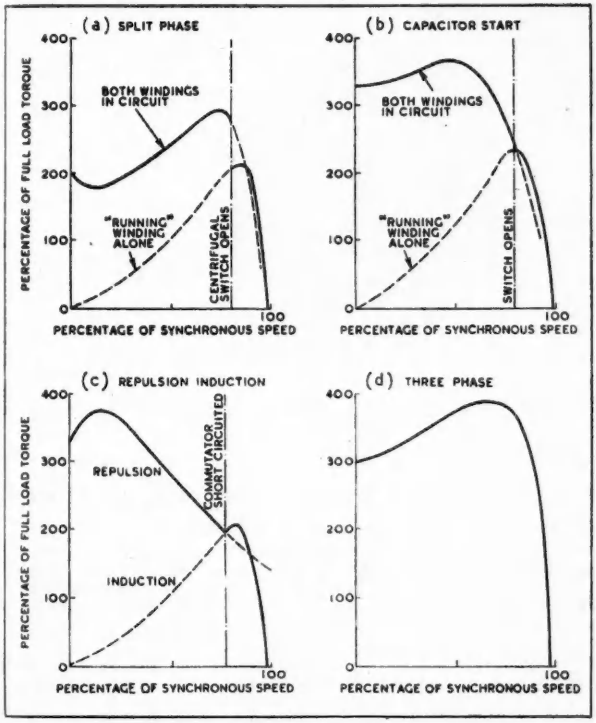


Fig. 4.—Typical speed-torque curves for f.h.p. motors

torque as the capacitor-start, with somewhat improved running characteristics, better power factor and quieter operation, but is more expensive.

Where high starting torque is secondary to good running performance, a continuously rated solid-dielectric condenser of relatively low value is permanently connected in series with the one winding. This type of motor is most suitable up to about 1/20 HP. Its

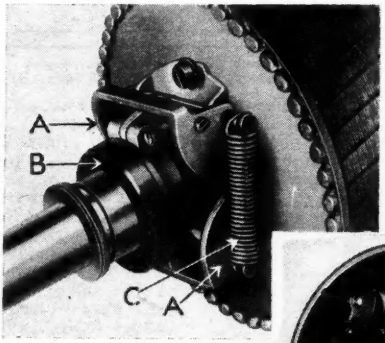


Fig. 6.—Centrifugal starting switch for AC motor (G.E.C.)

starting torque is 50 to 100 per cent. of full-load torque, with 300 to 400 per cent. full-load starting current. In larger sizes the relative starting torque falls off considerably.

Apart from the addition of condensers, the mechanical construction and dimensions of split-phase and capacitor motors are usually identical for machines giving similar outputs.

Repulsion-induction Motors

The repulsion-induction motor starts as a repulsion motor and is automatically changed over to induction running when full speed

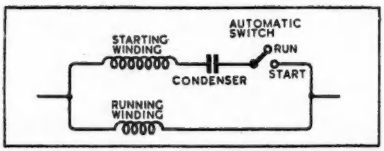


Fig. 7.—Circuit diagram of capacitor-start motor

is attained. The starting torque in small sizes ranges from 2½ to 3½ times that of the full load for between 2½ to 3 times the full-load current.

Only the stator winding is connected to the

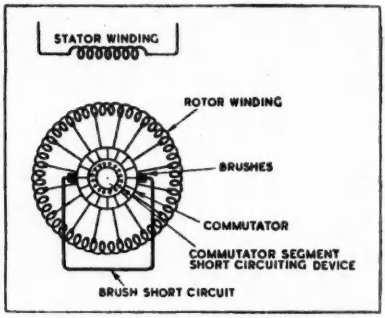
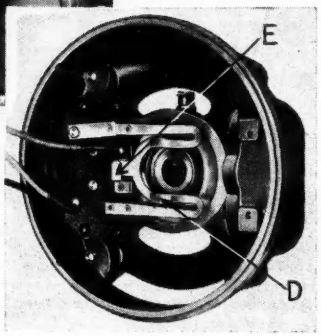


Fig. 8.—Circuit diagram of repulsion-induction motor

mains. The rotor is wound in a similar manner to a DC armature and has a commutator and brushgear. The brushes are connected together, thus giving a typical repulsion motor, which is inherently self-starting and possesses a high value of starting torque.



As the repulsion motor has a series characteristic in which the speed varies greatly with changes in load, a centrifugal device is arranged to operate when full speed is attained; this short-circuits all the commutator segments, making the rotor winding electrically equivalent to a cage rotor, with a corresponding change in the running characteristics to those of an induction motor.

Pooled Generating Costs

Ulster Proposal

A PROPOSAL has been put forward by the Northern Ireland Ministry of Commerce and Production for pooling the generating costs of Belfast Corporation, the Electricity Board and the Ministry.

The scheme originated with the Technical Advisory Committee which has been set up to advise the Ministry on all questions pertaining to electricity in Ulster. The pool, it is claimed, marks an advance which was not envisaged in the Electricity (Emergency Supplies) Act, 1942. It only concerns generating costs and the undertakings may retail their supplies at their own price as at present. The proposal has nothing to do with the merging of plant and it is not anticipated that it will affect the price of power or light to consumers.

Power Engineers' Salaries

Small Upward Adjustment

ABOUT three months ago the salary scale of the National Joint Board of Employers and Members* of Staff (Electricity Supply Industry) was revised upon the restoration of the " tax component " which had been deducted for the preceding year or so. Now owing to a slight rise in the cost of living during the latter half of last year it has been necessary to make a further revision, representing 4 cycles of 5 points of deduction from the datum figure of 125 per cent. This is in lieu of the existing 5 points deduction and is thus an increase of 1 point.

We set out above the new scale and remind readers that to some of the grades specific titles are attached, as follows:—1, Deputy chief official; 3, Power station superintendent or mains superintendent (with charge of substations); 4, Mains superintendent (without charge of substations); 7, Shift charge engineer (Class J and over); 8, Shift charge engineer (Classes A to H inclusive); 8b, Substation charge engineer; and 9a, Switchboard attendant.

In the table column (*a*) gives the salary for the first two years; (*b*) salary for the third and fourth years; and (*c*) salary after the fourth year. Employees in the London area are entitled to an additional 5 per cent. on the stated salaries and in any district where conditions justify lower remuneration a reduction of 5 per cent. in the rates can be made by agreement.

Capacity or Maximum Demand in Kilowatts

Grade	Class A 1,000–2,000			Class B 2,001–4,000			Class C 4,001–6,000			Class D 6,001–8,000			Class E 8,001–13,000			Class F 13,001–25,000		
	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)
1	519	531	543	554	571	588	605	616	625	636	651	666	—	—	—	—	—	—
2	453	463	473	483	498	513	528	538	546	556	571	585	600	615	629	—	—	—
3	409	418	428	437	451	466	479	487	496	504	518	531	544	551	558	565	578	592
4	354	366	378	390	397	406	414	426	439	451	463	473	485	492	498	505	522	539
5	335	344	352	361	372	383	394	400	408	415	426	436	447	458	469	480	486	493
6	306	317	326	337	344	352	359	369	380	390	395	402	408	418	429	439	449	458
7	277	287	296	306	317	326	337	343	348	354	363	373	382	391	400	409	414	419
8	277	282	287	292	297	301	306	315	323	332	337	343	348	357	366	375	383	391
8a	257	261	265	270	274	277	282	290	298	306	312	318	323	331	340	348	356	363
8b	239	241	245	249	252	256	260	267	274	280	286	293	299	307	315	322	329	336
9	—	—	—	—	—	—	239	244	250	256	262	269	275	282	290	297	304	310
9a	—	—	—	—	—	—	—	—	—	239	244	251	257	260	263	267	273	277
10	—	—	—	—	—	—	—	—	—	—	—	—	239	240	242	245	247	249

Grade	Class G 25,001–50,000			Class H 50,001–100,000			Class J 100,001–150,000			Class K 150,001–200,000			Class L 200,001–250,000			Class M Over 250,000
	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)	
3	605	619	634	649	670	691	710	728	746	765	784	803	823	843	864	885
4	555	567	579	591	606	621	636	652	669	685	702	719	737	756	774	793
5	499	515	530	545	555	566	576	591	606	620	636	652	668	685	701	719
6	468	477	487	497	512	527	542	555	569	583	598	613	627	643	659	676
7	424	438	452	466	473	482	490	503	515	528	542	554	568	583	597	612
8	398	403	407	412	424	437	449	461	471	483	496	508	521	534	547	560
8a	371	376	382	387	397	407	418	429	440	451	463	473	485	498	510	523
8b	343	349	356	362	371	380	389	398	408	418	429	440	451	463	473	485
9	317	323	330	337	344	352	359	368	378	387	396	406	416	427	438	449
9a	283	290	296	303	311	318	325	334	342	351	360	369	379	389	398	408
10	252	257	263	269	276	285	293	301	308	316	323	332	340	349	358	367
10a	239	244	250	256	262	268	275	281	289	296	304	312	319	326	335	343
10b	—	—	—	239	244	250	256	262	269	275	281	289	296	304	312	319
10c	—	—	—	—	—	—	239	244	251	257	263	270	275	282	290	297
11	—	—	—	—	—	—	—	—	—	239	244	251	257	263	270	275
11a	—	—	—	—	—	—	—	—	—	—	—	—	239	244	251	257
11b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	239

Proposed Extension of Schedule

At the November meeting of the National Joint Board (reported in the *Electrical Power Engineer*) the staff representatives urged that the schedule should be extended to stations up to 500,000 kW. The employers pointed out that there were very few undertakings with more than 300,000 kW of plant represented on the Board. It was replied that the

schedule was intended to be applied not only to represented undertakings but to others and in fact it had been adopted by some of the London companies although they were not members of the Board. Finally, the employers agreed to refer the matter to the Negotiating Committee.

Payment for Overtime

The staff representatives drew attention to the practice of certain undertakings of requiring their technical staffs to work systematic overtime, without payment, to keep them in line with the clerical staffs. It was contended that without a clear lead from the Board these undertakings were acting in an unauthorised manner. If the Board was of the opinion that overtime was necessary in order to assist the war effort the staffs would adhere to any recommendations made, but on the clear understanding that if the working week were extended payment should be made for the excess hours, as in the case of the clerical staff.

The employers expressed disapproval of the action of the undertakings in question and were of the opinion that it was not necessary to introduce any general system of overtime. They did not regard with favour the payment of overtime to technical staffs and the situation should be met by discouraging the practice of systematic overtime. Unlike certain munitions industries output did not bear any relation to the number of hours worked.

With the approval of the staff it was decided to circularise all constituent undertakings, calling attention to the fact that the working week ought not to be extended unless it was absolutely essential in the national interest.

Charge Engineers' Award

Charge engineers in Class J stations and upwards were recently, as the result of an award, placed in Grade 7 of the schedule. It appears that the undertakings concerned have interpreted this as meaning that the men are to be given the " first column " salary of their new grade, *i.e.*, increments for service are ignored.

The employers' side of the National Joint Board has agreed with this interpretation and the matter is being referred to the Industrial Court for a decision.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

" Reviews " for the Forces

IN response to the appeal on page 706 of your issue, dated December 4th, 1942, we acknowledge with grateful thanks receipt of *Electrical Reviews* from various sources. We deeply appreciate the spirit that enables competitive firms and others to take an interest in our men serving overseas and to help them in maintaining contact with matters electrical.

The following is typical of the requests we receive :—

INDIA : " Please send electrical papers. We are 20 miles from a town which boasts a bookseller, but though he thoroughly covers the technicalities of love and romance, he is not electrically minded."

London, W.C.2. THOS. DYKES,
Chairman,
G.E.C. Well-Wishers' Club.

Wartime Soldering

I READ with interest your editorial and the article by Mr. Richard Arbib in the December 18th issue of the *Electrical Review*. I agree with you that it is a poor policy to continue to sell soldering irons to operate between the limits of 200 and 250 V (with the same winding). The user of such an iron on a 200-V circuit will probably find that when he has a fairly heavy operation to do he has not sufficient heat, whereas the user on a 250 V circuit will have to keep re-tinning the bit because of the excessive heat, and he may also damage costly apparatus.

The rate of dissipation of the heat generated is a very important factor, depending on the nature of the work and the rate of the soldering operations. For any particular operation there is a best, or critical, temperature to be maintained; with an ordinary soldering iron that is difficult to obtain, but with an electric iron it is easy, though seldom taken advantage of.

I have found that for a general-purpose iron the best results are obtained when for a given weight of copper bit a fairly high rating in watts is given and the iron is controlled by means of a series regulator, or adjustable choke. The use of this regulator enables one to adjust the flow of the heat to the work in hand, which may be of a light nature on one set of operations and heavy on another set.

With a 200-W iron, for instance, the full power is switched on, starting from cold, and the iron is ready for use in a few minutes. When operations are started the regulator can be used to reduce the wattage as desired to suit the work in hand, or if the operator is called away for a short period he can adjust the regulator to its lowest wattage, which

allows the iron to generate just sufficient heat to melt 60–40 " Multicore " solder. If a 30 or 40 degree C. temperature is required, then due to the balance of power it can easily be obtained.

The use of series regulators is not new; in fact they were used in America during the last war, but we have been slow to realise their advantages in this country.

The ideal outfit of the future will probably take the form of a low-voltage iron operated from the supply mains through a small tapped transformer, giving the necessary regulation, the advantage being a much more robust iron element because of the larger cross-section of the element wire, or tape. Also, there would be less chance of breakdown and no earth wire would be necessary, while the iron would be perfectly safe where unskilled labour was concerned.

Electric soldering irons designed on the above principle, with or without regulators, for either standard or low voltage will be shortly available to those engaged in priority work. VARIFLOW.

An Engineers' Centre

MR. Harris's suggestion in your issue of December 25th for an " Engineers' Centre " is a most interesting one and deserves the consideration of the leading Institutions. I believe that a similar proposal was put forward in your editorial comments shortly before war broke out, and now that post-war plans are in preparation it is worth while sounding opinion again.

There is in New York City a fine central building administered by United Engineering Trustees, Inc., and housing the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Mining and Mechanical Engineers and the American Society of Civil Engineers. Several auditoria are provided, there are offices for the several Institutes and a large joint Engineering Societies Library. The Engineering Societies Building was made possible by the gift of $1,050,000 by Mr. Andrew Carnegie after it had been brought to his notice that a need existed for such a Centre.

The British Institutions are well founded financially but probably would need some assistance towards a similar scheme. If engineers as a group are to play their full part in the future it is desirable that they should speak through some representative body rather than individually as specialists. A Centre would help greatly towards this integration and make more efficient the social relations of engineering. A joint foundation could keep a watch on the status of the engineer, operate an appointments register and conduct a much needed engineering public relations office which would endeavour to represent to the lay public the work of the engineer and act as an office of information on engineering matters.

St. Albans. DENIS L. JOHNSTON,
Grad.I.E.E., Assoc.Amer.I.E.E.

Rational Distribution

THERE are two points in Mr. F. J. Elliott's article in your issue of January 1st with which I find myself in hearty agreement. The first concerns application forms and the procedure for obtaining supply. It would almost seem that the idea in some cases is to discourage, not encourage, the intending consumer, such is the complicated process of letter writing, form-filling, reference finding, etc., which has to be gone through. If it be argued that all this is necessary to avoid the possibility of bad debts, then surely the answer is the use of prepayment meters, when there appears to be no reason why the simplest possible form of application could not be used.

The second point is regarding special tariffs for off-peak use. While I admit there is something to be said for them in theory, and the idea of filling in the valleys in the load curve is quite sound, I wonder sometimes if the maintenance of all the necessary time switches, special meters, supervisory control systems and other methods of controlling the off-peak load, does not more than counterbalance the advantages gained. It would seem to me that the better method of approach is to encourage the long-hour use of power-consuming devices where this is possible and to rely on the diversity of demand from others to reduce the effects of peaks arising from the use of apparatus such as cookers, which do definitely come on at more or less fixed periods of the day.

There is also the psychological aspect that while the consumer who is able to take advantage of off-peak rates is quite happy to get cheap electricity, the consumer who is not so able and who has to pay higher rates may become dissatisfied on that account.

Basingstoke. R. J. HARLEY,
B.Sc., A.M.I.E.E.

Light from the Sky

AS you suggested in your issue of December 18th, when commenting on a recent proposal to effect street illumination by the reflection of searchlight rays from clouds, such a scheme would fail on a cloudless night and this would be unfortunate if the night happened also to be moonless. It occurs to me, however, that when stations such as Battersea and Fulham are using their flue-gas washing plant (after the war) something might be done. Their chimneys then give off clouds of white vapour and if the discharge from each chimney had say three projectors trained on it, illumination over a fairly considerable area could doubtless be obtained. W.S.K.

New Year Honours

Many Electrical Men Included

THE 1943 New Year Honours List is a lengthy one, and from it we give below the names of those gentlemen engaged in the electrical and associated industries who are included.

In the Prime Minister's list knighthoods have been conferred upon **Mr. G. H. Nelson,** chairman and managing director of the English Electric Co., Ltd., for services to the Ministry of Aircraft Production and the Ministry of Supply ; **Mr. Johnstone Wright,** chief engineer of the Central Electricity Board, a member of the Fuel Efficiency Committee set up by the Ministry

Mr. Johnstone Wright

Mr. G. H. Nelson

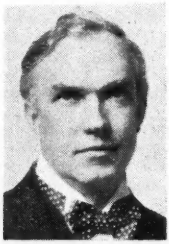
of Fuel and Power, and a past-president of the I.E.E. ; **Mr. W. Murray Morrison,** vice-chairman and managing director of the British Aluminium Co., Ltd. ; **Mr. W. T. Cobbett,** clerk to the Alderley Edge and Wilmslow Electricity Board (for public services, Manchester) ; and **Mr. A. B. Winder,** director and general manager of the English Steel Corporation, Ltd.

The C.B.E. has been awarded to **Mr. P. J. Robinson,** city electrical engineer, Liverpool ; **Mr. R. S. Pilcher,** general manager of the Corporation Passenger Transport Department, Manchester ; and **Mr. C. P. Snow,** for services relating to telecommunications.

The O.B.E. (Civil Division) is awarded to **Dr. C. Dannatt,** M.I.E.E., head of a section of the Research Dept. of the Metropolitan-Vickers Electrical Co., Ltd. ; **Mr. H. J. Green,** chief civil engineer, London Passenger Transport Board ; **Mr. C. O. Stanley,** managing director, Pye, Ltd. ; and **Mr. L. G. Bolton,** electrical engineering manager, H.M. Dockyard, Malta, now employed in the Admiralty.

Dr. C. Dannatt

Among those who become Members of the Order of the British Empire are **Mr. D. C. Birkinshaw,** A.M.I.E.E., engineer-in-charge at Daventry, B.B.C. ; **Mr. A. Charles,** managing director of Smith Meters, Ltd. ; **Mr. A. L. Chilcot,** A.M.I.E.E., chief engineer, Electronics Dept., Ferranti, Ltd. ; **Mr. F. W. Lawrence,** works manager, Stothert & Pitt, Ltd. ; **Mr. E. C. S. Megaw,** G.E.C. Research Laboratories ; **Mr. T. W. Morgan,** works manager, Marconi's Wireless Telegraph Co., Ltd. ; **Mr. A. Parkinson,** joint managing director, Crompton Parkinson, Ltd. ; **Mr. R. H. Perkins,** chief inspector, Guildford Area, G.P.O. Telephones ; **Mr. H. Simms,** works manager, Rotax, Ltd. ; **Mr. S. J. Hubbard,** senior depot engineer, railways, L.P.T.B. ; and **Mr. J. U. Vass,** works manager, Consolidated Pneumatic Tool Co., Ltd.



Mr. R. S. Pilcher

Mr. P. J. Robinson

The India Office list includes **Mr. P. J. Edmunds,** Chief Engineer Posts and Telegraphs, India, who becomes a C.I.E. ; **Mr. L. Henshaw,** superintending engineer, Electricity Department, Madras, who is awarded the O.B.E. ; **Mr. K. I. Brown,** Executive Engineer, P.W.D., Irrigation (Hydro-Electric) Branch, U.P., (M.B.E.) ; **Mr. A. A. Cabral,** Departmental Assistant Engineer, Government Telephone Exchange, Bombay (M.B.E.) ; and **Mr. M. L. Melvill,** Superintendent Railway Telegraphs, B.B. and C.I.R. (M.B.E.).

Government Changes

MINISTERIAL changes and appointments announced last week include Mr. W. S. Morrison as Minister Designate for Town and Country Planning, his present position of Postmaster-General to be filled by Capt. H. C. Crookshank, when Parliament has passed the Bill establishing the new Ministry. Mr. H. Strauss is Under-Secretary Designate. Sir William Jowitt is appointed Minister without Portfolio and Lord Cherwell becomes Paymaster-General in his place, while Mr. H. Macmillan is appointed to the newly-created office of Resident Minister at Allies' Headquarters, North-West Africa.

Other appointments are Mr. R. Assheton as Financial Secretary to the Treasury (in place of Capt. Crookshank), his present position of Under-Secretary, Ministry of Supply, being filled by Mr. Duncan Sandys whose place as Financial Secretary to the War Office will be taken by Mr. A. Henderson.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AFTER forty-one years' service with Newcastle-on-Tyne transport and electricity undertaking, **Mr. W. T. Dalton,** chief engineer, has tendered his resignation which has been accepted with regret by the Transport Committee. Mr. Dalton, who was born in London, started his career with Siemens Bros. & Co., Ltd. In 1901 he became assistant electrical engineer to Newcastle-on-Tyne Corporation two days before the city's tramway service was started. Mr Dalton has served under four general managers during his service at Newcastle-on-Tyne, and has seen the change-over of a large part of the city's tramway service to trolley and motor buses.

Lieut.-Cmdr. C. F. Nock, R.N. (Retd.)., has been awarded the D.S.O. for courage, endurance and devotion to duty in minesweeping. Lieut.-Cmdr. Nock, who rejoined the Navy at the outbreak of war, was a member of the staff of Hopkinson Induction Motors (now Hopkinson Motors & Electric Co., Ltd.).

Mr. C. Bradley, A.M.I.E.E., has been appointed deputy general manager and engineer to the Finchley Corporation Electricity Department. For some time he has been consumers' engineer at Finchley, and previously was with the Dumfries County Council, being responsible for much of the design and construction of the extensive distribution scheme under the county electrical engineer. He later turned to the commercial development of the county scheme.

Mr. J. W. Bache was the guest of the Cheltenham Municipal Officers' Guild, at a social gathering held at the Town Hall last week. As a token of their esteem the members of the Guild presented him with a canteen of cutlery and a shaving mirror. Mr. Bache is retiring after thirty-seven years' service as borough electrical engineer.

Mr. R. Dowson, of Morpeth, Northumberland, manager of the Mechanical Research and Development Dept. of C. A. Parsons & Co.'s Heaton works, Newcastle-on-Tyne, has had the degree of Doctor of Philosophy in the Faculty of Engineering conferred upon him by the University of London. Mr. Dowson was apprenticed at the Parsons works in 1909 and was afterwards closely associated with the late Sir Charles A. Parsons.

Mr. Floyd A. Lewis, formerly associate editor, has been appointed acting editor of *Electrical Engineering*, the official journal of the American Institute of Electrical Engineers, in the absence of the editor, **Mr. G. Ross Henninger,** who has joined the United States Army Specialist Corps with the rank of lieutenant-colonel.

Mr. F. A. Spence Brown has been appointed a director of Johnson, Matthey & Co., Ltd., as from January 1st. He joined the company in 1913, spent ten years at its Birmingham branch and five years in Sheffield with its associated company, Oakes, Turner & Co., Ltd., of which he is also a director. Throughout these periods he was closely associated with the manufacturers of jewellery, silverware and electro-plate. Since 1940 he has been engaged in the development of the company's processes for vitreous enamelling and metallising glass and pottery. He has travelled extensively at home and abroad.

Mr. S. T. Allen, who recently retired from the position of manager of the Central England Area of the Central Electricity Board, informs us that his address is now 58, Westfield Road, Edgbaston, Birmingham.

Sir Percy Mills (W. & T. Avery, Ltd.), who has been Deputy-Director of Ordnance Factories, Ministry of Supply, has been appointed Chief Adviser on Production Progress. **Sir Charles Craven** (Vickers-Armstrongs), is to be Industrial Adviser to the Ministry of Production.

Mr. W. W. Weaver, managing director of Waygood-Otis, Ltd., has been appointed, in addition, chairman of the company, chairman of Waygood-Otis (South Africa), Ltd., and a director of the Australian company. He succeeds the late Mr. D. W. R. Green.

Mr. Joseph Higham, lecturer in electro-technics at Manchester University, has been appointed assistant director of the department. In the Faculty of Technology, **Mr. M. W. H. Davies,** B.Sc. (Wales), A.M.I.E.E., has been appointed lecturer in high-voltage engineering.

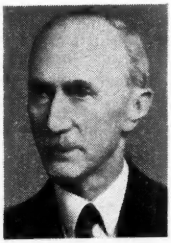
On the occasion of his seventieth birthday on December 28th, **Mr. W. A. Pearman,** general manager of the London Power Co., Ltd., was presented by his colleagues and staff with a silver

Sir Leonard Pearce presenting a silver salver to Mr. W. A. Pearman

salver. Sir Leonard Pearce, the engineer-in-chief of the company, in making the presentation, paid tribute to the eminent services rendered by Mr. Pearman to London's electricity supply during fifty-two years with the former Westminster Electric Supply Corporation, which he joined in 1890, and the London Power Co., Ltd., since its inception in 1927. During the whole period Mr. Pearman had never been absent for one day through ill-health, and Sir Leonard expressed the hope that his services would be

available for many more years to come. In reply, Mr. Pearman referred to the progress on the engineering side of the industry during the past fifty years, and compared the 20-kW rope-driven sets of the old days with the 100,000-kW turbo-alternators installed in the Battersea station.

Mr. C. F. Bowman, telephone sales manager in the Apparatus Department of Siemens Bros. & Co., Ltd., has retired after thirty-four years' service with the company. *Siemens Magazine*, the company's house journal, states that Mr. Bowman commenced his career in the Central Telegraph Office and in 1897 joined the Indo-European Telegraph Co., spending seven years in that company's transmission and relay stations. On his return to this country he took a refresher course in Siemens Laboratory at King's College, and after some years of experimental and laboratory work in connection with telegraph and telephone equipment and installation, he went to the United States in 1908 on a tour of inspection of automatic and semi-automatic telephone exchanges. He entered the service of Siemens Bros. in 1909, on his return to this country, and has negotiated telephone business on the company's behalf not only at home but in many European countries. His friends in the company have presented him with a wireless set as a parting gift.



Mr. C. F. Bowman

Merz & McLellan announce that **Mr. H. H. Baker** retired from partnership on December 31st. Mr. Baker has been associated with the firm for over forty years, during sixteen of which he has been a partner.

Mr. W. M. B. Furniss has been appointed manager of the Electric Construction Co., Ltd., as from January 1st. Following upon the removal of the head office of the company to Wolverhampton, **Mr. E. G. Homewood,** A.C.A., secretary, has made Bushbury Engineering Works, Wolverhampton, his headquarters. Other recent appointments include **Mr. R. Jay,** chief mechanical engineer, **Mr. F. A. Meir,** works superintendent, and **Mr. H. Patten,** sales manager.

Obituary

Sir Reginald Blomfield.—In the course of a letter to *The Times*, Mr. J. R. Beard refers to the fact that Sir Reginald Blomfield, the eminent architect who died last week, was consulting architect to the Central Electricity Board. The Board, when constructing the grid, realised the importance of minimising possible adverse effects on the amenities of the countryside. Sir Reginald was responsible for certain modifications in the design of the towers which improved their appearance without diminishing their efficiency or appreciably increasing their cost. The principal modification consisted in giving a slight inward taper to the upper panel of the structures which, by a well-known architectural effect, resulted in the sides of the panel appearing to be vertical, whereas a parallel-sided panel would have given the optical appearance of being flared outwards. "Those of us who have seen much of pylons abroad realise how this slight architectural modification gives a certain element of grace to our British pylons."

Mr. W. G. Bond, who was resident director of the Shropshire, Worcestershire and Staffordshire Electric Power Co., and the Midland "Red" Bus Co., died at Edgbaston on Christmas Eve. He was born at Eastbourne in 1863 and he was educated on the Continent and at Hurstpierpoint, Sussex. He then went to the Oxford Military College and from there to the Royal Military College, Sandhurst. After receiving a commission in the Hampshire Regiment he served in this country, in Malta, and in Ireland at the time of the Parnell riots. While still a young man, he retired from the army and took a year's course in electrical engineering. Shortly afterwards he joined the staff of the *Electrician* and remained with this journal for ten years, the last three years as editor. In 1899 he joined the British Electric Traction Co. with which he remained for the rest of his life. In 1911 he went to Birmingham as general manager of the several tramway undertakings of the B.E.T. in the Black Country then known as the Birmingham & Midland Tramways Joint Committee. At that time the Joint Committee had also under its control cable tramways, horse buses (the parent of the Midland "Red") and electric power and lighting undertakings in Smethwick, Oldbury, etc. These various companies were ultimately merged into the S.W.S. Co. and the Midland "Red" Bus Co. For many years Mr. Bond was a member of the Joint Industrial Council for the Tramway Industry. Apart from his work, he had a life-long interest in literature and had written several books.

Mr. D. Robertson.—We regret to report that Mr. David Robertson, F.C.A., chief accountant of the County of London Electric Supply Co. and its associated companies for twenty-one years, died on Saturday last as the result of a street accident on Christmas Day. Cremation took place at Golders Green on Wednesday.

Mr. Robertson was a member of the Executive Committee of the County of London Co. organisation, a member of the Council of the Incorporated Association of Electric Power Companies, and financial adviser to the Provincial Electric Supply Association. He had served on various committees of the supply industry dealing with rating and taxation.

Mr. S. J. Grey, Lord Mayor of Manchester for two periods, who died last week, was a director of Joseph Lucas, Ltd.

Power Station Deaths

ON Monday last two members of the staff of the Derby and Notts Electric Power Co. were found shot dead at the company's Spondon power station ; a revolver and two spent cartridges were found near them. The men were Mr. E. H. Lynam (46), station superintendent, and Mr. C. H. Dawson (41), charge engineer.

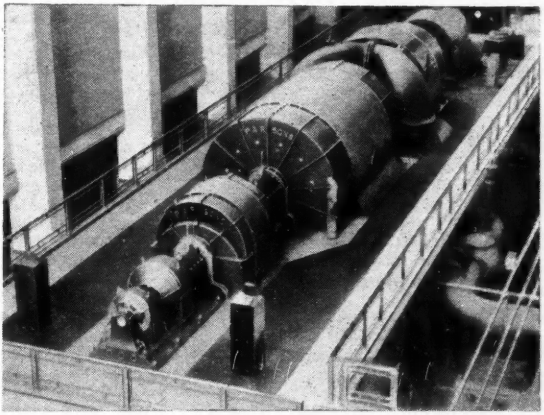
Manufacturing Progress—I

Developments during the Past Year

As an essential force in the prosecution of the war the electrical manufacturing industry has continued, in spite of obstacles, to build noteworthy plant for use at home and overseas. The following article briefly mentions some of the principal items produced during 1942 *by the leading electrical manufacturers. Further notes will appear in subsequent issues.*

C. A. Parsons & Co., Ltd.

DURING the past twelve months a number of important turbo-generating installations have been put into commission by C. A. Parsons & Co., Ltd. The largest machine had an output of over 50,000 kW, with steam conditions of 650 lb. per sq. in. and 825 deg. F.



Parsons 50,000-kW, 33-kV, tandem turbo-alternator with single-ended l.p. cylinder (650 lb. per. sq. in., 825 deg.)

The turbine consists of two cylinders in tandem, the low-pressure cylinder being single-ended. The alternator generates at 33 kV. The condenser has a cooling surface of 60,000 sq. ft. to maintain a vacuum of 28·5 in. Hg. Other sets of large output are 40,000-kW and 30,000-kW units with surface condensing plant. Smaller sets for home power stations include one of 7,500 kW of the pass-out type, and another of 4,000-kW and 3,430-kW units.

Turbo-alternators for abroad include a 20,000-kW 1,500-RPM unit for an Australian power station. The turbine is of the single-cylinder type and operates with steam conditions of 350 lb. per sq. in. and 800 deg. F. and with a vacuum of 28·5 in. Hg. The alternator generates at 6·6 V, 25 cycles.

A 7,500-kW turbo-alternator for the Central Argentine Railways has also been set to work. Smaller machines include the first of two turbo-geared centrifugal pumps for the Rand Water Board, South Africa, and a 1,250-kW geared turbo-alternator for a sugar company in Australia. The turbine for the last machine is of the back-pressure type, the whole of the power being developed with the steam required for process purposes.

Orders have been received for a further turbo-alternator of over 50,000-kW capacity and for one of 40,000-kW capacity, both with surface condensing plant, and for 15,000-kW turbo-alternators. For an Australian power station there are on order two 30,000-kW turbo-alternators, for which the condensing plant and feed water heaters will be manufactured in Australia to the designs and drawings of the company.

For other parts of the world work is in hand for turbo-alternators with outputs of from 25,000 kW down to 4,000 kW. A back-pressure turbo-alternator of 12,000 kW is designed for steam conditions of 400 lb. per sq. in., and 752 deg. F., and to exhaust at 156 lb. per sq. in. gauge.

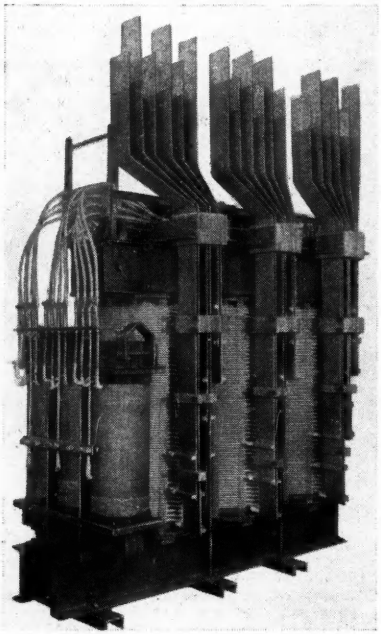
Among the principal contracts completed by the transformer department during the past year are a 15,000-kVA, 66/20-kV, ON/OFF unit with a separate radiator bank (the ON continuous rating being 7,500 kVA), a 10,000-kVA, 33/11-kV, and two 5,000-kVA, 21/6·6-kV, transformers. Two 2,800-kVA furnace-type transformers have been designed to deliver 40,000 A on the low-voltage side. Many distribution transformers ranging from 30 kVA to 4,000 kVA have been despatched overseas. A large three-phase current-limiting reactor giving 10 per cent. reactance in a 22,000-kVA, 6·3-kV system has also been completed. A similar reactor is on order.

Many orders have been received during the year for medium-sized distribution transformers, a good proportion of these being

for export. Among the larger are 20,000-kV, 5,750/20,000-kV step-up transformers for British power stations and a repeat order for further 10,000-kVA banks with a voltage ratio of 110/6·35 kV for export.

Metropolitan-Vickers

During the past year engineering developments on the part of Metropolitan-Vickers Electrical Co., Ltd., were generally in the direction of improvements to standard lines. A number of turbo-alternators was completed, the largest of which was of 67,000-kVA capacity. Others of 37,500-kVA at 3,000 RPM were supplied to British municipalities,



Met.-Vick. three-phase, 50 cycle, 11,000/200-V furnace transformer, from the l.v. side, with reactors on the left

in addition to which many (including a 40,000-kVA 3,000-RPM set) were shipped abroad. Several of the alternators ordered were to be wound for 33 kV. There was also a considerable demand, home and overseas, for self-contained turbo-alternators of 3,000-kW or so. The bulk of generators for Diesel-electric sets have been of relatively small output (*e.g.*, 36 kW) of the mobile or semi-portable types for giving emergency supplies, but some of 500 kW (stationary type) have been sent out to the tropics.

Among the orders in hand for large induction motors are several for rolling mills of from 220 to 1,500 HP and for winders and haulages. The largest motor was of 5,000 HP at 1,500 R.P.M. A special development has been the supply of a number of two-bearing 100-kW 3,000-RPM motor-generators for delivering current at 10,000 cycles to induction furnaces for heat-treatment of steel parts. Synchronous-induction motors (mostly with V.A.X. automatic excitation) have also been built for air compressors, ore crushers and colliery fans. Seven further boiler-house installations embodying the company's DC unified control system with Ward-Leonard equipment have been put into commission.

Motor-control apparatus has been in heavy demand. One noteworthy instance was of forty-five oil-break starters assembled on three boards to control, with pre-set sequences and interlocking, squirrel-cage and slip-ring motors driving conveyors and crushers on an ore-handling and sintering plant. New developments are represented by a 3·3-kV oil-break latched-in contactor designed to close on 26,000 A and by a thermal cable-stripping machine.

In the traction field, in addition to a demand for industrial shunting locomotives, a notable order was for ten locomotives for the South African railways similar to the 164 previously supplied. A large turnover is reported in track circuiting relays and coloured-light signal equipment as a result of extensions to certain lines and the speeding up of railway services.

In the transformer department, the most notable work was in connection with three 60-MVA, 132/33-kV, mobile units for the Central Electricity Board—each weighing 110 tons, including oil during transport, but without cooling equipment. Other orders have been received from abroad including many for three-phase transformers up to 30 MVA. Outputs of sets under construction for electric furnaces range from 1,500 to 6,000 kVA giving three-phase low-voltage currents up to 20,000 A.

Several extensions to metal-clad switchboards have been carried out at power stations and large substations using oil-immersed single-break circuit-breakers with rupturing capacities of 750 and 1,500 kVA. Low- and medium-voltage air-break h.r.c. circuit-breakers of up to 4,000 A have been constructed for industrial service.

Equipment has been developed to meet the requirements of the new B.S. 1071 relating to AC arc-welding plant, including transformers for three- to twelve-operator sets with regulating reactors for currents of 300 and 600 A. For butt welding, 160 equipments have been ordered giving outputs up to about 20,000 A. In order to provide weld consistency for heavy work at speeds higher than those possible normally, several special-

purpose automatic arc welders have been evolved. The urgent need for non-porous highly ductile welds (particularly for liquid containers) has caused a great demand for atomic-hydrogen arc-welding equipment of the simpler and more compact designs now available. A new mild-steel electrode has been produced in addition to those providing a bullet-proof deposit.

The range of welding manipulators has been extended to include a 6-ton unit and a 2-ton unit has been added which incorporates motor drives for both elevation and rotation, the latter giving a table speed that corresponds roughly with the speed of welding and facilitates the employment of relatively unskilled men. An experimental 250-kVA resistance welder has been supplied with extension arms permitting light welds to be made at a 3-ft. throat depth in addition to heavy spot and projection welding with a shorter throat. Steady orders are being received for 60-kVA machines for flash-butt welding and for 120-kVA machines for the repair of damaged parts.

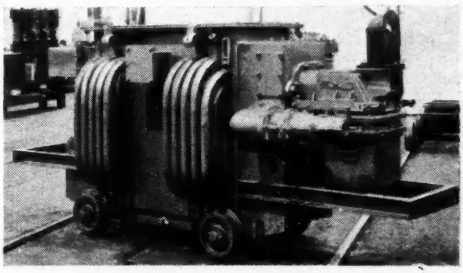
Gasfilled tungsten-filament lamps of the 250-W, 100–130 V, series-burning type have been developed for drying processes. In a typical case a reduction in stoving time from 24 hr. to 1 hr. 10 min. was reported.

Research activities have necessarily been generally confined to assisting design and manufacturing sections with improved material and processes. Among numerous investigations are those into the uses of woven glass fabrics and their impregnation and also to determining by means of the "greenness tests" the best temperature and winding speed for each batch of resin-treated paper. Creep tests have been continued on special steels and also on non-ferrous alloys. Investigations and testing have also been carried out for other organisations.

Bruce Peebles & Co., Ltd.

Prominent among last year's developments in the normal products of Bruce Peebles & Co., Ltd., is the incorporation of air filters or coolers in the stator frames of alternators, thus obviating excavation of the basement for air-ducts. An example of such self-cooling machines is a 3,750-kW totally enclosed alternator supplied to an Australian mining company. Overseas orders have been put in hand for nineteen alternators of from 350 to 1,500-kW of the open-ventilated type for coupling to steam turbines through gears. Upwards of 250 alternators for oil-engine driving ranging from 20 to 250 kW are in various stages of production.

Typical of the orders for converting plant are a 1,250-kW rotary convertor for a steel works in this country and two 250-kW motor generators for India. Three 2,000-kW (4,000-kW overload) 600-V steel-cylinder dual-frequency traction rectifiers were supplied to a public authority here together with 6·6-kV transformers and switchgear. Transportable 150-kW, 200-V double-cubicle outdoor glass-bulb rectifiers, twelve in number, and transformers capable of being operated on 11-, 6·6- or 3-kV systems were completed for emergency water pumping in England. Orders for rectifiers range from 920 kW to 100 kW.



Bruce Peebles 100-kVA, 200/420-V mobile mining type transforming substation with h.v. flameproof draw-out oil circuit-breaker

Noteworthy examples of motors in hand are three 1,900-HP 11-kV low-speed synchronous-induction machines, six of 550 HP of similar type for driving air compressors and forty-two of round about 850 HP for collieries, many of them flameproof. Work completed in 1942 included a large number of AC motors up to 620 HP for Empire countries.

Of the numerous transformers completed or under construction the largest was a 20,000-kVA, 132/6·6-kV unit for the Central Electricity Board. There were also seven 10,000-kVA units which, in addition to many others of from 6,000 kVA downwards, were built for supply authorities in this country, and two 10,000-kVA dual-voltage-ratio transformers and fifty-five of various ratings between 500 and 50 kVA for export. Many orders have also been received from collieries for mobile transformer substations with flameproof switchgear of the type illustrated.

Atkinson Memorial Lecture

A LEGACY of £100 bequeathed to the Royal Society of Arts by the late Llewelyn B. Atkinson, a former chairman of the Council, has been devoted to the provision of a lecture every three years, preferably on some subject connected with electrical science or engineering. The first of these lectures will be held on Monday, February 1st, at 1.45 p.m., when Dr. P. Dunsheath, O.B.E., will speak on "Industrial Research in Great Britain : a Policy for the Future."

COMMERCE and INDUSTRY

Economy Campaign Effects. Wages and Hours.

Fuel Economy Progress

LAST month the increase in coal used for electricity generation compared with a year ago was only 1·6 per cent., whereas in December, 1941, it was 13·6 per cent. This encouraging evidence of the progress of the fuel economy campaign is given in a statement issued by the Ministry of Fuel and Power. Between April and December, 1941, the monthly increases in coal consumption by the gas industry varied from 3·7 to 11·7 per cent. and by the electricity supply industry from 12 to 15·4 per cent. In June, the month before the campaign started, the increases were 8·6 and 9·7 per cent., respectively, but by the end of the year they had fallen to 2·2 and 1·6 per cent. Incidentally, December was the first month in which the electrical figure was below that for gas.

In a general survey it is stated that from the reports of Regional Controllers it is evident that the domestic consumer is, with rare exceptions, making a determined effort to save, and the results are very encouraging. One interesting point in the regional reports is a statement by Sir John Dalton (London & South Eastern Region) that the rise in the consumption of electricity by users taking their supplies through slot meters has stopped, which he attributes to the publicity given to the matter. The reports also give evidence of notable savings industrially and in the Services.

A circular is shortly to be sent to 48,000 selected non-industrial establishments, such as hospitals, schools, offices, cinemas, blocks of flats, etc., requesting that fuel watchers should be appointed, and badges are to be provided similar to those for factory fuel watchers.

High-Speed Steels

By a direction of the Ministry of Supply, Iron and Steel Control, the manufacture of "6-6" quality high-speed steel now ceases and all L.T. licences already granted, or to be granted, will be executed in molybdenum "4-6" high-speed steel when existing stocks of the "6-6" quality have been exhausted. A leaflet has been issued by the Ministry for the guidance of users. It contains an analysis of "4-6" steel, which gives equal performance to "6-6" and requires the same hardening treatment.

Fixed Capacitors

A new British Standard Specification has recently been published for fixed capacitors (B.S. 1082). This specification is based on technical information supplied by the British Electrical and Allied Research Association, which has carried out considerable experimental work with a view to revising and extending the scope of the 1926 edition of B.S. 271.

The latter specification was limited in scope to the small capacitors used at that time in radio receivers but the considerable extension of radio broadcasting in recent years, and the parallel developments of other activities involving the use of fixed capacitors, clearly necessitated the drafting of a more comprehensive specification. The present specification covers all fixed capacitors for general purposes whatever the nature of the electrodes and insulant. It is not, however, intended to apply to capacitors for specialised application.

Copies may be obtained from the British Standards Institution, 28, Victoria Street, Westminster, S.W.1, price 2s. (2s. 3d. post free).

Wages in the Contracting Industry

The National Joint Industrial Council for the Electrical Contracting Industry announces that the cost of living (war adjustment) is to remain at 18s. 9d. per week up to and including the first pay-day in April next.

Working Hours

Some time ago the Ministry of Works and Planning directed that the maximum weekly hours of work in the building and civil engineering industry should be 60, and that there should be no Sunday work except in special circumstances which were specified. These special circumstances have now been extended. They include the repair of services, war factories and essential houses damaged by enemy action, work necessary in the interests of health and safety, work of exceptional urgency in the war effort authorised by the Ministry, preparatory work necessarily done during the week-end or out of working hours to enable the hours worked by the general body of workers to be productive, railway and tidal work and the unloading of wagons to avoid transport delay Continuous shift work is also included but it is provided that the working week shall not exceed six days (including Sunday, if worked), nor the total number of hours worked exceed sixty.

Flameproof Fittings Price Increase

The Electric Light Fittings Association announces that the wartime advance in the price of flameproof fittings, from January 1st, is 45 per cent. instead of the previous 33⅓ per cent., the increase being due to the rise in material and production costs.

E.R.A. Annual Meeting

The annual general meeting of the British Electrical and Allied Industries Research Association is to be held at the Institution of Electrical Engineers at 12 noon on February 12th.

Fracture Treatment

The Ministry of Labour and National Service, 8, St. James's Square, London, S.W.1, has issued a leaflet (PL113/1942) dealing with fracture treatment and rehabilitation under the Emergency Hospital Scheme. When this scheme was first introduced it was intended mainly to cope with air-raid needs and to help the Services, but it has now been considerably developed and caters for large classes of the

population, and extensive orthopædic and fracture treatment services have been evolved. It applies to war industry in a wide sense, including public utility undertakings, building and civil engineering, mining, transport, etc., and the service is available whether or not the injury is sustained during employment.

Electricity Supply Works Committees

The General Purposes Committee of the London and Home Counties J.E.A. reported at yesterday's meeting of the Authority that a letter had been received from District Council No. 10 (Greater London Area) stating that the trade union side of the Council had proposed that constituent undertakings should be asked to grant requests made by employees for the establishment of works committees.

Before giving the matter consideration the Council was seeking the views of constituent members and information regarding any works committees already appointed. The General Purposes Committee said that it had replied that the Authority was in favour of the principle of the establishment of works committees, subject to further consideration by the Authority of the constitution and functions of such committees.

Control of Bearings

The Minister of Supply, Sir Andrew Duncan, has decided to bring the ball and roller bearing industry under formal control, and he has appointed Mr. C. Maxwell Norman to be Controller of Ball and Roller Bearings. The Control is at Steel House, Tothill Street, London, S.W.1.

Torch Battery Production

Considerable increase in the manufacture of batteries for torches and cycle lamps is announced by the Board of Trade which says that the production during December was almost a third more than in previous months while there will be a further increase in January. In order to discourage the use of No. 8 batteries, which are considered to be uneconomical, no torch cases of this size have been made since September but the batteries are still being made in large quantities.

E.I.B.A. (Northern Counties)

The annual general meeting of the Northern Counties Area of the Electrical Industries Benevolent Association will be held on Monday, January 25th, at 3.0 p.m., at Tilley's Restaurant, Blackett Street, Newcastle-upon-Tyne 1, under the chairmanship of Mr. L. E. Mold, O.B.E., M.I.E.E.

National Savings Tank Drive

The Central Electrical Co., Ltd., has received congratulations from the Holborn Savings Committee on its effort in connection with the National Savings Tank Drive, as a result of which the name of the company's group will be inscribed on a tank.

Fatality

A soldier, Edwin White, aged thirty-two, received a fatal shock while trying to repair a broken electric light wire, and at the inquest at Christchurch, a verdict of "Death from Misadventure" was recorded. The C.O. of his unit stated that White had attempted to mend the wire without anyone's permission in order to get a light in the cookhouse. Had the break in the wire been reported to the proper quarter steps would have been taken to have it repaired. Mr. E. J. Searle, electrical engineer, said that deceased had been on the shed roof, which was a metallic conductor. There was a broken "live" wire in contact with earth. The wires were installed in accordance with the regulations.

Undertakings' Accounts

The Directions and Orders relating to the publication of the accounts of gas and electricity undertakings have been consolidated in a new Order—the Accounts General Direction & Order, 1942, made by the Minister of Fuel and Power (S.R. & O. 1942 No. 2631, Stationery Office, 1d.).

Boys for the Army

The War Office is inviting applications from boys between the ages of 14 and 15½ for training in the trades of armourer, artificer, blacksmith, bricklayer-mason, carpenter, electrician, fitter, instrument mechanic, wireless and line operators, radio mechanic and sheet metal worker. Candidates will be required to pass an educational test. Applications should be made to a recruiting officer before January 30th.

Calendars

Fitter & Poulton, Ltd., have again sent us a neat calendar with an old-world picture of an angler returning with his catch, followed by two cats, with the title "Anticipation." The monthly sheets show also the preceding and following months.

Trade Announcements

The Contracts Engineering Dept. of Drake & Gorham, Ltd., has returned from Sunbury-on-Thames to the company's headquarters at 30, Grosvenor Gardens, S.W.1. The Secretarial and Accounts Departments remain at Cuckfield and the Goods Department and store at Sunbury.

The Manchester office of the Simplex Electric Co., Ltd., has been removed to more commodious premises at Orient House, Granby Row, Manchester, 1 (telephone: Central 1933/4/5).

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following :—

ROLLO plugs.

Peru's Electrical Imports

Supplies from Argentina and Brazil

THE Peruvian Government has issued returns of the country's foreign trade in 1941. Some marked decreases are noticeable in the cable group and other less important items, and the only noteworthy increases were in radio apparatus, batteries and refrigerators.

On the whole there was a small increase in value compared with 1940, but this was probably scarcely enough to represent the rise in price. Rather more than three-quarters of the total trade was done by the United States. The share of the United Kingdom, which has never been large, was poorer than in the two preceding years, and below those of Argentina, Canada and Switzerland. The more frequent appearance of manufactures of neighbouring States was a feature of the year's trade; Brazil as well as Argentina has sent electrical goods to Peru. There are ample supplies of both sterling and dollar exchange. (20 soles = £1 approx.)

	1941 Soles (000)	Inc. or dec. on 1940
Switches, circuit-breakers, etc.—		
Total	974	+ 104
From Argentina	27	+ 27
„ United States	777	+ 32
„ Great Britain	16	+ 5
„ Canada	8	− 19
Batteries up to 30 kg. and parts—		
Total	750	+ 60
From Canada	34	− 32
„ United States	682	+ 122
„ Great Britain	31	+ 13
„ Japan	2	− 17
*Batteries over 30 kg. and parts**—	78	+ 47
Insulators—		
Total	184	− 6
From United States	125	− 31
„ Great Britain	4	− 10
„ Canada	28	+ 28
Insulated wire and cable up to 3 mm.—		
Total	459	− 296
From United States	378	− 142
„ Great Britain	3	− 8
„ Canada	60	− 10
Covered copper wire over 3 mm. diam.—		
Total*	321	334
Wire and cable up to 3 mm. lead-covered—		
Total	35	− 98
From United States	16	− 3
„ Great Britain	11	+ 11
„ Brazil	6	+ 6
Flex, covered with fabric—		
Total	40	− 10
From United States	19	− 21
„ Japan	16	+ 8
Copper wire over 3 mm. diam., lead-covered—		
Total	36	− 254
From United States	28	− 127
„ Great Britain	3	− 5
Wire, insulated or uninsulated, lead-covered or armoured—		
Total	247	− 53
From United States	106	+ 6
„ Canada	19	+ 19
„ Great Britain	113	+ 113
Telephone cable, lead-covered—		
Total	90	− 116
From United States	8	+ 1
„ Canada	58	+ 30
„ Great Britain	24	− 139
Telephone apparatus—		
Total	211	− 4
From Argentina	18	+ 18
„ United States	69	+ 69
„ Sweden	59	+ 59
„ Great Britain	2	− 2
Radio apparatus—		
Total	2,951	+ 1,250
From Argentina	593	+ 489
„ Great Britain	6	− 24
„ United States	2,260	+ 940
Heating apparatus over 10 kg., including industrial—		
Total	380	− 460
From United States	327	− 123
„ Switzerland	47	− 73
Household heating apparatus, not over 10 kg.—		
Total	99	+ 15
From United States	87	+ 17
„ Switzerland	10	+ 10
Ammeters, galvanometers, etc.—		
Total	197	+ 27
From United States	179	+ 19
„ Switzerland	13	+ 13
Switchboards—		
Total	160	− 510
From United States	124	− 156
„ Belgium	7	− 343
Lamps up to 50 W.—		
Total	626	+ 61
From Brazil	90	+ 88
„ United States	373	+ 93
„ Japan	120	+ 20
Lamps 50 to 200 W.—		
Total	334	+ 14
From United States	247	+ 47
„ Japan	11	+ 11
„ Sweden	1	− 45
*Lamps over 200 W.**—	127	—
House meters—		
Total	344	+ 50
From Switzerland	137	+ 30
„ Canada	191	+ 51
Electro-medical apparatus—		
Total	436	− 534
From United States	412	+ 262
„ Brazil	19	+ 19
Current transformers over 1 kW and rectifiers over 3 A.—		
Total	767	− 103
From United States	548	− 232
„ Switzerland	190	+ 120
Radio valves—		
Total	217	+ 2
From Great Britain	15	− 30
„ Holland	9	− 8
„ United States	173	+ 38
*Vacuum cleaners, etc.**	145	+ 92
Insulating tubes—		
Total	169	+ 79
From United States	152	+ 72
„ Canada	10	+ 8
*Fans**—	50	− 50
*Refrigerators**—	1,020	+ 457
*Fractional HP motors**—	147	+ 27
Dynamos and spare parts—		
Total	185	+ 15
From Great Britain	13	+ 7
„ United States	158	+ 43
„ Switzerland	12	− 8

* Mainly from United States.

Export Trade

Organisation to Meet Altered Conditions

By H. W. Bosworth

AMONG the many proposals being put forward by trade organisations, chambers of commerce or private groups to ensure post-war prosperity, one feature is stressed by common consent, and that is the paramount necessity for increasing, or at least maintaining, our export trade, with or without help from the Government. The electrical industry has played a great part in building up export trade; it has, indeed, done more than its share in the past twenty years, and it certainly now behoves the leaders of the industry to consider the policy they will pursue in the future under the changed conditions that are likely to exist.

As a first step it is well to consider the means by which the greater part of our electrical export trade has been obtained in the past, and to see how the sources of such orders are likely to be affected in the future. The principal sources of export contracts have been as follows :—

Loss of overseas investments and the growth of local manufacture in many countries are two factors which will adversely affect our post-war trade. The author suggests that joint selling companies form the most promising means of meeting the new circumstances

(*a*) *Direct Overseas Inquiries.*—There have been times when users abroad have sent inquiries direct to British manufacturers, based probably on advertisements. They have waited for the quotation and placed orders on the often scanty information sent out after long delay from home. Even in pre-war days such methods were out of date and such business is never likely to be obtained again in quantities worth consideration.

(*b*) *Merchant Houses.*—The export merchant house has played a great part in spreading British manufactures throughout the world and may still handle a good deal of trade in standardised consumable articles, but as a means of selling heavy plant or technical products its day is past and the changes to be expected are merely an acceleration of an existing trend.

(*c*) *Direct Purchase by Users in England.*—In the days when this country owned railways, mines, oilfields, etc., in all parts of the world, a rich source of export business was the head office of the overseas company, usually situated in London, strongly British, conservative in policy and prepared to pay for and use high-quality products. Under stress of war finance we have parted with most of our overseas investments and the ownership of these companies is in foreign hands. Head offices and buying offices have been transferred to the overseas territory and most of the business will be decided in the territory. Local manufacturers will receive increasing consideration and, if imported goods are used, stocks will be expected to be available in the country and a high standard of technical service will be essential. Typical instances of this class of trade were afforded by the South American railways, Indian collieries, African copper and gold mining industries, etc. This class of business will need very special consideration.

(*d*) *Government and Official Purchases.*—Vast sums of money have been spent in London in the last fifty years by Dominion Governments, the India Office, the Crown Agents for the Colonies and similar buyers. We can still hope that official business will provide considerable export trade ; in fact, the development of the Crown Colonies is one of the most promising sources of demand for the future. The conditions, however, are changing and the views of the local engineering staffs are now rightly determining in many instances the placing of the orders. The changed conditions under which Indian Government business is placed are typical of these developments.

(*e*) *Developments financed from Great Britain.*—Loans to overseas countries usually result in substantial business for the lender, but past history has shown that in many cases such business has in reality been little more than a free gift by the lender. Both America and Britain have suffered in this respect and it is probable that some form of international co-operation for financing development and reconstruction will be devised. It should be noted that usually such business is placed mainly with the very large manufacturing concerns.

(*f*) *Overseas Representation.*—The larger manufacturers, at any rate, have attempted to cover the greater part of the world, either by the appointment of local agents or by establishing in the better markets their own branch offices. This source of business has undoubtedly produced a great part of our export trade, but the cost of obtaining orders and the prices ruling have not in the past given much satisfaction to the manufacturer. The certainty of increased local manufacture will not make the position easier in the future.

This summary may appear to present a somewhat gloomy picture for the future, but the post-war period should provide a wealth of opportunity, and the British electrical industry with its unrivalled reputation and experience must rise to the occasion. If new methods and greater enterprise replace the old the industry should certainly have nothing to fear.

In this country industry is made up of a large number of medium-sized competing companies with a few very large composite concerns. It is hopeless to suppose that, say, ten or fifteen individual makers of transformers or switchgear can each maintain an adequate sales organisation in a country like China or Brazil and not only compete with the whole world for a share of the trade, but also compete keenly among themselves for such portion as may be available for Great Britain.

In the years following the last war a number of attempts were made to operate joint selling companies abroad, the selling company representing a group of non-competing manufacturers, covering a wide range of engineering products. For one reason or another practically all these companies failed to achieve their purpose. The selling company could not maintain a staff expert in every type of manufacture, nor did such a plan in any way limit the competition between British companies manufacturing similar goods.

Proposed Selling Organisation

An alternative and much more hopeful proposal which should be considered for the future is that in a given territory a selling company should be formed by a group of, say, half-a-dozen manufacturers, all at present competing in that market and all making the same or nearly similar products. Such a company could then absorb the pick of the existing sales staff in the territory and could afford expert technical engineers.

The selling company would have the advantage of the backing at home of several factories which would enable it to give better deliveries and possibly, in cases of keen competition, where one firm was unable to accept an order, one of the other constituents might be willing to do so. Instead of half-a-dozen firms carrying small and similar stocks, a much larger and wider range of plant could be carried in the territory. The selling company would be financed by capital provided by the constituents and should operate on the basis of paying a reasonable dividend on its capital as well as providing orders.

The orders obtained would, of course, be divided between the home companies, either on a predetermined quota basis or by some other arrangement. Obviously, complete confidence and good faith between the home companies would be essential, but no financial connection or control would be in any way necessary. One or more such organisations are already in successful operation.

Another important aspect of post-war conditions will be local manufacture in overseas territories. British companies have to decide whether they will themselves sponsor local manufacture and control it, or whether they will see it spring up under purely local control in direct competition with themselves. Such a selling organisation as referred to above might well also control the local production of standardised articles which, it is almost certain, will in many cases no longer be imported.

By providing a local product for part of their business the British manufacturers would strengthen their standing for obtaining the larger or more specialised products which cannot be efficiently manufactured locally. It is very desirable, if any such manufacturing has to be undertaken, that it should not be done by half-a-dozen British firms each running a small overseas factory, but rather by a group of firms operating on a scale that can be really efficient. It is also important in any such case that, even if the controlling capital is provided from Britain, some substantial share in the undertaking should be taken by local interests.

It is fairly certain that British manufacturers will have to devote more and more attention to the production of new products and to fresh electrical developments if they are to maintain a leading position overseas. Here again co-operation between makers of similar plant will be preferable to unlimited competition. Obviously, it is difficult to formulate definite plans at the moment, but our country was quite unprepared for the outbreak of war and it is now important that we should not be unprepared for the new era.

Audio-Transformer Distortion

HARMONIC distortion in audio-frequency transformers is dealt with in an 18-page booklet by Dr. Norman Partridge, King's Buildings, Dean Stanley Street, London, S.W.1. The non-linearity of the magnetic properties of iron commonly used for making transformer cores has been troublesome for a long time and there is reason to believe that the author's method of approaching the subject may well be successful in other applications. There has not hitherto been any well-recognised procedure for calculating the magnitude of distortion of this kind, nor means of comparing the relative merits of magnetic materials in this respect. The research described in this booklet, on which the author based a thesis approved by the University of London for the award of the degree of Doctor of Philosophy, was undertaken in an endeavour to remedy the lack of means referred to. The outcome has been the discovery of a number of important facts concerning transformer distortion and the establishment of a method, which is essentially practical, of treating relevant problems.

ELECTRICITY SUPPLY

Damage in Shelters. Falkirk Scheme Not Sanctioned.

Accrington. — SHELTER INSTALLATIONS DAMAGED.—Damage caused to electrical equipment in air-raid shelters and trenches has resulted in the Corporation discontinuing any connecting up of these places for the time being.

Burnley. — SIREN PRECAUTION. — Electric heaters are being fixed to each of the town's sirens to combat the effects of frost.

Dundee.—JOINT METER READING EXPERIMENT. —Although it had been pointed out that a number of towns had tried joint meter reading unsuccessfully the Finance Committee at its last meeting approved the scheme, together with the combined issue of accounts, for an experimental period of one year. Mr. G. F. F. Caldwell, treasurer, said he was satisfied that there could be a saving, but the benefit that would result to the City Collector's Department, where there was a much reduced staff, was more important. The system would allow four of the eleven meter readers to be transferred to other work.

Falkirk.—COAL HANDLING SCHEME.—The Electricity Commissioners have intimated to Falkirk Electricity Committee that they cannot at present approve the proposal to install a new mechanical coal and ash handling plant.

Hull.—SHELTER INSTALLATIONS.—The Town Council proposes to carry out heating and lighting work in school air-raid shelters at a cost of £1,407.

Lancaster.—SHOP LIGHTING CONCESSION.— The Electricity Committee has decided that, commencing with the March quarter, 1943, the fixed charge of the tariff for the lighting of business premises shall be reduced in accordance with the reduction in the permitted amount of lighting.

London.—EMPLOYMENT OF WOMEN AND BOYS. —It is reported that Hampstead Electricity Department is to employ women to read meters and repair electrical fittings, while boys of fourteen and fifteen are to test meters, taking the place of men who have joined the Forces.

Runcorn.—SHELTER HEATING.—The Rural District Council proposes to have heating apparatus installed in from 70 to 80 public shelters.

Swindon.—SUPPLY TO GAS COMPANY.—The Electricity Committee is seeking sanction to borrow £2,400 for an electricity supply to the Swindon United Gas Co.

Sedgley.—OVERHEAD LINES. —The U.D.C. has raised no objection to a proposal of the S.W. & S. Electric Power Co. to erect two overhead lines in the southern portion of the area.

Warrington.—SUBSTATION.—The Town Council has approved plans for the erection of a substation.

Overseas

Australia.—POWER INTERCONNECTION. — Hydro-electric power was transmitted for the first time from Burrinjuck (N.S.W. Government Southern System) to Sydney, a distance of 200 miles, in September last when surplus power became available as a result of the favourable winter rainfall. This was made possible by the completion of an interconnecting transmission line, with a capacity conservatively rated at 15,000 kW, between Sydney and Port Kembla. This new 150-mile line is designed for operation at 132,000 V, states the *Electrical Engineer and Merchandiser* (Melbourne), but the section between Burrinjuck and Goulburn is temporarily rated at 66,000 V owing to wartime delays in the completion of certain items of equipment.

Argentina. — INCREASED OUTPUT. — Figures compiled by the Argentine Association of Electric Power Producers and Distributors (representing 95 per cent. of the total for the Republic) show that sales of electric power during the six months ended with June last amounted to 1,045·3 million kWh, as compared with 977·7 million kWh in the first half of 1941, or an increase of 6·9 per cent.

Canada.—PROGRESS AT SHIPSHAW SITE.— Demolition of a hill barrier, for which nearly 100,000 lb. of explosive was used, marked the completion of the hydraulic portion of the large hydro-electric development at Shipshaw on the Saguenay River by the Aluminium Company of Canada. After the demolition water flowed from the river into the canal adjoining the power-house. Telegrams of congratulation included one from Mr. C. D. Howe, Minister of Munitions, who said that the demolition of the barrier and passage of water through the first generator at Shipshaw was an outstanding engineering achievement which took on added importance because of its vital position in relation to the war effort.

Eire.—IMPROVED STREET LIGHTING.—The city manager of Dublin stated recently that he had arranged for all-night street lighting to be restored in the city proper and added areas, and also, with the approval of the Department of Defence, for the cowling of lamps to be lessened at the outer edges, thus ensuring improved dispersion of light.

Italy.—INDUSTRIAL CONSUMPTION RESTRICTED. —Italian industrial concerns must reduce their electricity consumption by 15 per cent. as compared with last year under an official decree.

TRANSPORT

Australia.—TRAMWAY SERVICES.—A return issued by the Commonwealth Bureau of Census and Statistics, details of which are published in the *Electrical Engineer and Merchandiser* (Melbourne) shows that at June 30th , 1941, there were 589·6 route miles of tramways in Australia, 569 miles being electrically operated. With the exception of 13 miles the systems were all owned by Government undertakings. The number of tramcars in use was 3,488, with seating accommodation for 209,188 passengers. Construction of lines and equipment cost £26,706,421. During 1940-41 car-miles run were 78,347,000 and passenger-journeys numbered 741,292,000 (9·46 per car mile). The

quantity of electricity generated for traction was 276,335,000 kWh. Gross revenue amounted to £8,150,360, against £7,679,250 in the previous year, revenue per car-mile rising from 4·96d. to 6·17d. Working expenses amounted to £6,137,504 (£6,062,223) and the net revenue was £2,012,856 (£1,617,027).

Russia.—NEW "METRO" LINE.—It is reported that a third line of the city's underground railway, construction of which has been proceeding secretly, was opened last week. The new "tube" is four miles long and links the capital with the large Stalin factory and the dynamo plant in the industrial belt by a non-stop 8-minute service. The new station, named after the Stalin factory, has decorations of an industrial and martial character on its marble walls. In the entrance hall there is a large mural showing Red Army soldiers advancing, and the walls are adorned with mosaics designed by the late Prof. Vladimir Frolov, who died in the siege of Leningrad.

RADIO & TELEPHONY

Burnley.—POLICE RADIO.—The Watch Committee is purchasing a fixed transmitter-receiver, a mobile transmitter-receiver and a mobile receiver for police wireless equipment at a cost of £400, as part of the Home Office plans to improve police communications.

North Africa.—NEW RADIO TRANSMITTER.—According to a *Reuter* message from Washington, Mr. Milton Eisenhower, Associate Director of the U.S. Office of War Information and brother of General Dwight Eisenhower, recently announced that a 40-kW morse radio transmitter has been constructed for news distribution from North Africa.

Hydro-Electric Report

Proposals Criticised

A CONSIDERED statement on the report of the Committee on Hydro-electric Development in Scotland is issued by the Executive Committee of the Scottish National Party. Electro-chemical and electro-metallurgical industries are not the most desirable industries in the Highlands, it is claimed. They are heavy users of a relatively limited total potential power, and poor employers of labour. They are industries which will not lead to worthwhile ancillary development. Power once assigned to them cannot be directed later to more valuable local industries or other developments.

The report states that the provision of electricity to crofts and fishing villages for domestic and small power use is impracticable and uneconomic, but the National Party replies that the report of the Water Power Resources Committee of 1921 comes to a different conclusion in this regard. If electricity can be provided for small-power use in similar districts in Bavaria, Norway and North Wales, it can be done in Scotland.

The principle of public ownership and control of hydro-electric production undertakings, it is stated, is sound. All Highland undertakings, including those at present run by the Grampian Supply Co., should be under public Scottish ownership and control. Hydro-electric schemes in the Highlands, for whatever purposes, must be considered in relation to other development plans concerned with agriculture, etc. The proposals of the Committee, it is urged, might well prevent communities receiving electricity supply from nearby water resources to which they have the first right.

Forthcoming Events

Institution of Electrical Engineers.—*Wireless Section.*—Tuesday, January 19th, 5.30 p.m. Informal discussion on "Quartz Crystal Applications," by Capt. C. F. Booth.

Measurements Section.—Friday, January 22nd, 5.30 p.m. Paper: "Boiler House Measurements and Control for Efficient Fuel Utilisation," by Messrs. G. H. Barker and A. L. Hancock.

North Midland Students' Section.—Saturday, January 9th, 2.30 p.m. Griffin Hotel, Boar Lane, Leeds. Paper: "Low Head Hydro-electric Schemes," by Messrs. J. B. Higham and B. V. Poulston.

Western Centre.—Monday, January 11th, 5 p.m. Merchant Venturers' Technical College, Unity Street, Bristol. Paper: "Boiler House Measurement and Control for Efficient Fuel Utilisation," by Messrs. O. H. Barker and A. L. Hancock.

Scottish Centre.—Tuesday, January 12th, 6.15 p.m. Societies' Room, Royal Technical College, George Street, Glasgow, C.1. Paper: "Some Problems in the Application of Electric Heating to Residential and Commercial Premises," by Mr. W. Gilchrist.

Northern Ireland Sub-Centre.—Tuesday, January 12th. Paper: "Turbo-alternators: Important Changes that have Influenced their Design," by Mr. D. McFarlane.

West Wales (Swansea) Sub-Centre.—Saturday, January 16th. Chairman's address.

Irish Centre.—Thursday, January 21st. Paper: "Some Problems in Transmission Line Design," by Mr. A. Burke.

North-Western Centre.—Saturday, January 23rd, 2.30 p.m. Engineers' Club, Manchester. Paper: "Standardisation as applied to Industrial Electrical Instruments," by Lieut.-Col. K. Edgcumbe, T.D. *Students' Section.*—Saturday, January 16th, 2.30 p.m. Engineers' Club, Manchester. Paper: "High Vacua and Electrical Equipment," by Mr. F. Ashworth.

Bristol Students' Section.—Friday, January 29th. Bath. Paper: "Some Aspects of Switchgear Practice," by Mr. J. Fitzpatrick.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 8th. Paper: "Wartime Standardisation," by Mr. C. le Maistre, C.B.E., chairman of the Executive Committee of the British Standards Institution.

Association of Supervising Electrical Engineers.—Saturday, January 9th, 2.15 p.m. Lecture (second of series of three) on "Distribution of Electricity," by Mr. J. S. Blacklock.

Illuminating Engineering Society.—Tuesday, January 12th, 5 p.m. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2. Paper: "Proposals for a New Lighting Code," by Mr. H. C. Weston.

Institution of Civil Engineers. — Tuesday, January 12th, 2 p.m. James Forrest Lecture on "The Extreme Properties of Matter," by Sir Charles G. Darwin, K.B.E.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.*

1940

3456. "Boilers, hot water containers, and the like." A. V. Tomlinson (Fabrik Electr. Apparate Fr. Sauter Akt.-Ges.) February 23rd, 1940. (Convention date not granted.) (549817.)

1941

415. "Radio navigational instruments." Lear Avia, Inc. January 11th, 1940. (549847.)

1143. "Electrical testing appliances." P. De F. C. Pycroft. January 28th, 1941. (549901.)

1292. "Circuit arrangements for directional radio transmitters." Aga-Baltic Radio Aktiebolag. April 10th, 1940. (549958.)

2028. "Automatic telephone exchange systems." Standard Telephones & Cables, Ltd., L. P. Lowry and G. E. Peters. February 14th, 1941. (549848.)

3586. "Electrical measuring apparatus." Kapella, Ltd., and R. E. Reason. March 15th, 1941. (Cognate application, 4898/42). (549987.)

5004. "Electrical switches having spring loaded contact arms." Scophony, Ltd., and A. E. Adams. April 17th, 1941. (550045.)

5671. "Radio navigational instrument." Lear Avia, Inc. May 15th, 1940. (Addition to 549847.) (550013.)

5893. "Electric lamp manufacturing machinery." British Thomson-Houston Co., Ltd., S. R. Eade and W. H. Dawson. May 6th, 1941. (549824.)

5895. "Contacts for electrical switchgear," H. Astbury, and Crompton Parkinson, Ltd. May 6th, 1941. (549825.)

5974. "Electromagnetic interrupters." R. C. Graseby. May 8th, 1941. (549965.)

6136. "X-ray and other high-tension electrical apparatus." Machlett Laboratories, Inc. July 26th, 1940. (549796.)

7127. "Electrically operated sound producing horns." J. Lucas, Ltd., and O. Lucas. June 5th, 1941. (549826.)

7165. "Alternating-current rectifier apparatus of the dry, surface contact type." Westinghouse Brake & Signal Co., Ltd., L. H. Peter and S. A. Stevens. June 6th, 1941. (549830.)

7173. "Electromagnetic switches." Standard Telephones & Cables, Ltd., and P. A. Childs. June 6th, 1941. (Addition to 539238.) (549831.)

7189. "Gaseous electric-discharge devices and their manufacture." M. A. Claesson. June 6th, 1941. (549832.)

7197. "Electron tubes for amplifying high-frequency oscillations." Philips Lamps Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). June 6th, 1941. (550016.)

7198. "Pressure sensitive devices in which the displacements of a diaphragm are translated into an electrical effect." Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). June 6th, 1941. (549881.)

7201. "Incandescent cathodes for use in gas- or vapour-filled discharge tubes." Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). June 6th, 1941. (549992.)

7368. "Protective or warning tiles applicable for covering underground cables and the like." H. J. Baldwin & Co., Ltd., and E. V. Byers. June 11th, 1941. (549968.)

7387. "Supports for thermionic valves." Standard Telephones & Cables, Ltd., L. W. Houghton and S. J. Holdstock. June 11th, 1941. (549970.)

7389. "Electromagnetic relays." Standard Telephones & Cables, Ltd., F. E. Newton and S. H. Towner. June 11th, 1941. (549971.)

7458. "Electrical amplifying apparatus." L. Sterling. August 8th, 1940. (549976.)

7495. "Telegraph transmitters." Creed & Co., Ltd., A. E. Thompson and R. D. Salmon. June 13th, 1941. (549978.)

7496. "Manufacture of electric insulating bodies." Standard Telephones & Cables, Ltd., T. R. Scott and E. C. Lee. June 13th, 1941. (549994.)

7509. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. June 15th, 1940. (550047.)

7522. "Telegraphic transmitters." Marconi's Wireless Telegraph Co., Ltd., and H. J. H. Wassell. June 13th, 1941. (549979.)

7524. "Rotary electric switches." Marconi's Wireless Telegraph Co., Ltd., C. S. Cockerell and D. C. Seymour. June 13th, 1941. (549980.)

7576. "Devices for oscillographing electrical or mechanical processes." Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). June 14th, 1941. (Addition to 515027.) (549996.)

7800. "Electrical systems or circuit arrangements for producing an electrical impulse with variable time delay." M. A. Claesson. June 21st, 1940. (549998.)

7867. "Telephonic instruments." T. Hamilton-Adams. June 23rd, 1941. (Cognate application, 9165/41.) (549859.)

8139. "Telephone systems." Siemens Bros. & Co., Ltd., and D. P. Long. June 27th, 1941. (550054.)

8229. "Thermionic amplifier circuit arrangements." Marconi's Wireless Telegraph Co. Ltd. June 29th, 1940. (549834.)

8336. "Safety circuit for cathode-ray tubes." E. G. Gage. July 2nd, 1941. (549835.)

9052. "Electric circuit-breakers." British Thomson-Houston Co., Ltd. July 17th, 1940. (550026.)

9223. "Deaf-aid apparatus." C. A. Becker. July 22nd, 1941. (550002.)

9320. "Electric transformers." British Thomson-Houston Co., Ltd. July 23rd, 1940. (549861.)

9712. "High-voltage electric windings." B.T.H. Co., Ltd. August 2nd, 1940. (549863.)

9799. "Facsimile telegraph signalling system." Standard Telephones & Cables, Ltd. August 10th, 1940. (550005.)

9886. "Dynamo-electric machines having

sliprings." Harland Engineering Co., Ltd., and L. Greenwood. August 4th, 1941. (549805.)

9973. "Temperature regulator." Landis & Gyr Soc. Anon. September 28th, 1940. (549939.)

10050. "High-voltage power supply systems." Hazeltine Corporation. September 21st, 1940. (549865.)

10301. "Electro-optical reproduction of sound." Kodak, Ltd. October 18th, 1940. (549907.)

10784. "Electric-discharge tubes." Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). August 23rd, 1941. (550032.)

10930. "Electrically controlled valves." H. A. Stevenson. August 27th, 1941. (549910.)

11029. "Sockets for electrical apparatus." British Thomson-Houston Co., Ltd. August 30th, 1940. (550035.)

11037. "Direct-current electric supply systems comprising motor driven boosting generators." J. Stone & Co., Ltd. May 14th, 1941. (550036.)

11268. "Electric terminal sockets." Kersons Manufacturing Co., Ltd., and C. W. Parsons. September 3rd, 1941. (550056.)

11394. "Electric fuse distribution boards." Dorman & Smith, Ltd., T. Atherton and J. Lund. September 6th, 1941. (549940.)

11431. "Conduits for electric cables." A. H. Stevens, and G. A. Stevens. September, 8th, 1941. (549840.)

12064. "Electron camera." Standard Telephones & Cables, Ltd. September 24th, 1940. (549890.)

12065. "Broadcasting antenna systems." Standard Telephones & Cables, Ltd. September 25th, 1940. (550009.)

12803. "Train describing signalling systems." Standard Telephones & Cables, Ltd. A. Brown and A. J. Mullarkey. April 18th, 1941. (Divided out of 542078.) (549891.)

13099. "Mechanically operated electrical contact mechanism having magnetic biasing." K. L. Jensen. October 10th, 1941. (549844.)

13223. "Damping of vibrations in members." R. N. Arnold and Metropolitan-Vickers Electrical Co., Ltd. October 14th, 1941. (549893.)

13868. "Dust-collecting filters for vacuum cleaners." Electrolux, Ltd. (Aktiebolaget Elektrolux). October 28th, 1941. (549809.)

14890. "Electric metal-vapour discharge tubes." Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 19th, 1941. (549810.)

1942

4071. "Carrier frequency telephone system." Standard Telephones & Cables, Ltd. October 22nd, 1940. (549948.)

4180. "Attenuation equaliser." Standard Telephones & Cables, Ltd. October 24th, 1940. (549926.)

4182. "Unattended mechanical repeater." Standard Telephones & Cables, Ltd. October 31st, 1940. (549927.)

6227. "Electrolytic condenser." Standard Telephones & Cables, Ltd. March 25th, 1941. (549952.)

9265. "Process for electrodepositing iron and electrolyte therefor." United States Rubber Co. October 18th, 1941. (Addition to 543137.) (549954.)

Factory Distribution

THE design of electrical distribution systems within large factories is discussed from both technical and economic aspects in a paper presented by Mr. J. S. Blacklock to the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.

It is pointed out that estimates of load should include forecasts of future extensions, which must be gauged by experience since they are not governed by rules. It is advisable to bear in mind that while transformers can be readily added to, or changed, to suit growing load, the layout of feeders and arrangement of switchgear as originally designed can be modified only at appreciable cost. Also, it is most uneconomical entirely to ignore the diversity factor of the system.

The extremely important effects of power factor are referred to, particularly in respect of cable-size calculations and tariff penalties. The influence of fault-current magnitudes on distribution gear is illustrated by a straightforward short-circuit calculation, which emphasises the need for switchgear to be properly selected with a view to adequacy in abnormal circumstances. Different means of operating circuit-breakers, remotely and manually, as well as the benefits of incorporating back-up fuses, are briefly mentioned in leading up to the need for automatic protective equipment, the basic principles of the several systems being outlined.

The paper concludes with recent estimates for a shop containing 128 machine tools, needing an average of 3 HP per machine, which show the most expensive system to be v.i.r. cable in conduit above the line of machines with special detachable fused tee-boxes suitably inserted for conduit drops to provide a fused circuit to each individual machine. The difference between the cost of busbar distribution with self-isolating fused outlets for each machine and that of overhead p.b.j. wiring with isolators and conduit drops favours the last mentioned system, but the author's opinion is that the busbar method is attractive because it should give longer service when carefully designed, being better able to dissipate heat and therefore capable of carrying overloads more effectively.

High-voltage Trolley-buses

IT is reported in *Modern Transport* that plans have been made for the introduction in Cadiz, Spain, of a network of trolley-bus routes operating from a high-voltage supply on the lines of the Altstatten-Berneck system in Switzerland, inaugurated in September, 1940, and said to be the first in the world to use high voltage. The system will link Cadiz with the neighbouring towns of San Fernando, Puerto Real, Puerto de Santa Maria, Jerez, Sanlucar, Chipiona and Rota.

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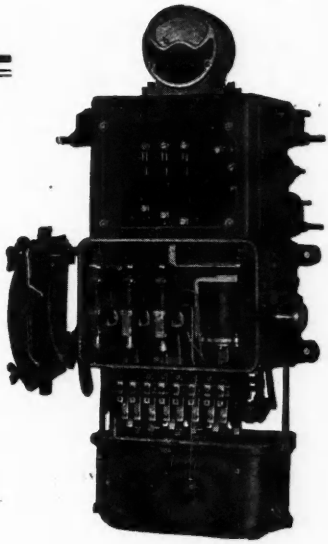

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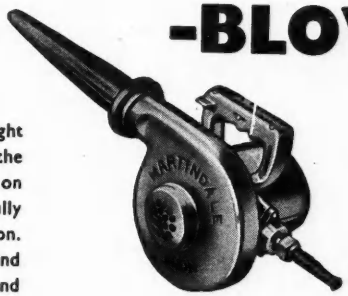

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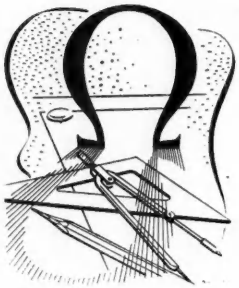

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Fuller details of this and other Mallory alloys are given in our technical booklets, which will be sent on request.

PHYSICAL PROPERTIES OF MALLORY 3 CASTINGS

Maximum stress, tons/sq. in.	**22**
Proof stress (0.1% extension), tons/sq. in.	**15**
Limit of proportionality, tons/sq. in.	**12**
Elongation	**20%**
Brinell hardness	**110**
Electrical conductivity	**80%**

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G.D.16

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Sterling Industries, Ltd., reports a profit for 1941 of £2,366 as compared with a loss of £13,940 in the previous year, reducing the debit carried forward from £30,579 to £28,213. The chairman, in a statement accompanying the accounts, says that the appointment to the board of Sterling Electric Holdings, Ltd., of additional directors not on the board of Sterling Industries gives that company the possibility of independent consideration of loan, as recommended by counsel.

Final agreement as to the true indebtedness of the company in this regard may now be determined. Subsequent steps to fund this obligation should go some way towards clearing the air and freeing the way for final rehabilitation of the company.

The Brazilian Traction, Light & Power Co. announces a settlement of the dispute between the company and the Brazilian authorities with regard to the latter's claim for income tax. The amount has been reduced from $7,800,000 to $5,400,000, which is considered by the directors to be satisfactory.

New Companies

E. **Siegrist, Ltd.**—Private company. Registered December 23rd. Capital, £5,000. Objects : To carry on the business of manufacturers of, and dealers in, electric cables, insulating materials, electric railway and tramway apparatus, electric household utensils and accessories, etc. Directors : E. Siegrist (Swiss), 26, Park Court, Park Hall Road, West Dulwich, S. F. Hanks, 85, Yewtrel Road, Southborough, Tunbridge Wells, Kent, and J. H. S. Haas, Prince's Court, Queensway, W.2. Registered office : 39, Berners Street, W.1.

B. & H. (Nottingham), Ltd.—Private company. Registered December 30th. Capital £7,000. Objects : to acquire the business of a heavy switchgear electrical apparatus manufacturer carried on by John G. Berry at Popham Street Works, Nottingham, as " John Berry," and to carry on the business of manufacturers of, and dealers in, electrical plant and supplies, tramcars, motor and trolley buses and other vehicles, wireless apparatus and accessories, etc. Directors: J. G. Berry and G. K. Berry, both of 18, Glebe Road, West Bridgford, Nottingham.

Multiple H. & D. Industries, Ltd.—Private company. Registered December 19th. Capital, £1,000. Objects : To carry on the business of electrical engineers and contractors, mechanical, civil and consulting engineers, manufacturers of, and dealers in, electrical goods, etc. Directors : N. E. Hewitt, 102, Mortlake Road, Kew Gardens and S. G. Double, 78, Parkside Drive, Cassiobury Park, Watford. Registered office : 4, Leysfield Road, W.12.

Thermec Utility Co., Ltd.—Private company. Registered December 14th. Capital £1,000. Objects: To carry on the business of engineers, manufacturers of thermo-technical mechanical appliances, components and plant, regulators, switches, thermostats, etc. Directors: G. Yem, manager of Automatic Section of Lightfoot Refrigeration Co., Ltd., and Catherine J. Yem, both of 10, Thetford Road, New Malden, Surrey. Registered office: 59, Kingston Road, New Malden, Surrey.

Hodgsons (Houghton-le-Spring), Ltd.—Private company. Registered December 16th. Capital £800. Objects : To acquire the business of an electrical engineer and wireless and cycle dealer carried on by Edward Hodgson at 46, Newbottle Street, Houghton-le-Spring. Directors : E. Hodgson, Mrs. A. Hodgson and T. Caygill, all of Marklerigg, East Rainton, Fence Houses, Durham, and A. E. Hodgson, 25, Silksworth Lane, Sunderland.

Asprey & Suchy, Ltd.—Private company. Registered December 17th. Capital, £1,500. Objects: To carry on the business of electroplaters, electricians, mechanical and electrical engineers, chemical manufacturers, manufacturers of, and dealers in, oils, paints, varnishes, synthetic and plastic materials and proprietary articles, etc. Directors: L. Asprey, Anne C. Asprey, Emmy Suchy, E. Nelson and R. W. Banks. Solicitors: Barnett & Gluckstein, W.1.

Cineluxe, Ltd.—Private company. Registered December 28th. Capital, £500. Objects : To carry on the business of manufacturers of, and wholesale and retail dealers in, cine goods, electrical appliances, vacuum cleaners, refrigerators, fans, television and radio goods, etc. Directors : F. G. L. Benson and Maud L. Benson, both of Greenfield Avenue, Carpenders Park, Watford, Herts. Secretary : Winifred S. Ward. Registered office : 1, Birkdale Avenue, Pinner, Middlesex.

Branchflower Electrical (Wholesale), Ltd.—Private company. Registered December 22nd. Capital, £3,000. Objects : To carry on the business of wholesale factors of, agents for and dealers in, electrical apparatus, appliances, fittings and accessories for commercial, industrial, medical, household or personal use, etc. V. L. Bell, C.A., 27, Downshall Avenue, Seven Kings, Essex, is the first director. Registered office : 27 and 28, Old Jewry, E.C.2.

London Sound Laboratories, Ltd.—Private company. Registered December 21st. Capital, £100. Objects : To carry on the business of manufacturers and repairers of, and dealers in, radio and sound producing machines, television sets, batteries, accumulators, electrical goods and accessories, etc. J. K. Harris, 51, Berkeley Court, N.W.1 is the first director. Registered office : 15, Devonshire Row, E.C.2.

Companies Struck Off the Register

The names of the following companies have been struck off the Register and they are thereby dissolved :—Berwicke Radio Services, Ltd. ; Faraday Allwave Wireless, Ltd. ; Gillan Radio-Electric, Ltd. ; Interocean Radio, Ltd. ; Rapid Electric Arc Welding & Metals Co., Ltd.

Companies' Returns

Statements of Capital

Altrincham Electric Supply, Ltd.—Capital, £310,000 in 49,650 1st preference, 103,350 2nd preference and 100,000 ordinary shares of £1 and 228,000 deferred shares of 5s. Return dated July 29th. 45,000 1st preference, 63,350 2nd preference, 100,000 ordinary and 228,000 deferred shares taken up. £155,350 paid on 45,000 1st preference, 10,000 2nd preference, 75,000 ordinary and 101,400 deferred shares. £110,000 considered as paid on 53,350 2nd preference, 25,000 ordinary and 126,600 deferred. Mortgages and charges outstanding at date of return: £30,000.

Northwood Electric Light & Power Co., Ltd.—Capital, £290,000 in 6,880 cumulative preference and 283,120 ordinary shares of £1 each. Return dated July 16th. 6,880 preference and 279,680 ordinary shares taken up. £215,775 paid on 6,880 preference and 208,895 ordinary shares. £70,785 considered as paid on 70,785 ordinary shares. Mortgages and charges: Nil.

Weston-super-Mare & District Electric Supply Co., Ltd.—Capital, £215,000 in £1 shares (40,000 cumulative preference and 175,000 ordinary). Return dated June 18th (filed July 6th). All shares taken up. £100,000 paid. £115,000 considered as paid. Mortgages and charges : Nil.

B.E.T. Electricity Supply Co., Ltd.—Capital, £750,000 in £1 shares. Return dated July 2nd. 749,000 shares taken up. £440,388 paid. £308,612 considered as paid. Mortgages and charges : £352,378 1s. 8d.

Dawlish Electric Light & Power Co., Ltd.—Capital, £40,000 in 40,000 ordinary shares of £1 each. Return dated July 24th (filed August 6th). All shares taken up. £40,000 paid. Mortgages and charges : Nil.

East Devon Electricity Co., Ltd.—Capital, £350,000 in £1 shares. Return dated July 24th (filed August 13th). All shares taken up. £315,000 paid. £35,000 considered as paid. Mortgages and charges : Nil.

Buckrose Light & Power Co., Ltd.—Capital, £200,000 in £1 shares. Return dated June 30th. 180,000 shares taken up. £180,000 paid. Mortgages and charges: Nil.

R. Marshall Carr, Ltd.—Capital, £500 in £1 shares. Return dated September 14th. 350 shares taken up. £350 paid. Mortgages and charges : Nil.

Electrical & Steam Appliances, Ltd.—Capital, £100 in £1 shares. Return dated December 30th, 1941 (filed August 17th, 1942). 2 shares taken up. £2 paid. Mortgages and charges : Nil.

S.E.P., Ltd.—Capital, £5,100 in £1 shares. Return dated August 25th. 3,190 shares taken up. £706 paid. £2,484 considered as paid. Mortgages and charges : Nil.

Frank Wall & Co., Ltd.—Capital, £1,000 in 1,000 shares of £1 each. Return dated July 30th (filed August 18th). All shares taken up. £1,000 paid. Mortgages and charges: Nil.

Electric Development & Securities Trust, Ltd.—Capital, £1,000,000 in £1 shares. Return dated August 18th. All shares taken up. £576,890 10s. paid (£1 per share on 264,401 shares, 15s. on 149,986 shares and £2 on 100,000 shares). £523,109 10s. considered as paid (£1 on 485,613 shares and 5s. on 149,986 shares). Mortgages and charges : Nil.

Batwin Electric Motors, Ltd.—Capital, £10,000 in 1,000 preference and 9,000 ordinary shares of £1. Return dated June 25th. 1,000 preference and 5,202 ordinary shares taken up. £602 paid. £5,600 considered as paid. Mortgages and charges : Nil.

Mortgages and Charges

Grierson, Ltd.—Two charges on proceeds of contracts, dated November 29th and 30th, 1942, to secure all moneys due or to become due from the company to Westminster Bank, Ltd.

E.G.S. Co., Ltd.—Mortgage on properties in Leeds and Birmingham, dated December 8th, 1942, to secure £20,000 and all other moneys from time to time due from the company to chargees (Newcastle-upon-Tyne Permanent Building Society).

Bill Switchgear, Ltd.—Satisfaction to the extent of £1,000 on October 16th, 1942, of charge dated January 25th, 1937, and registered August 10th, 1937.

Underwood (Electric), Ltd.—Satisfaction in full on December 15th, 1942, of mortgage dated March 15th, 1939, and registered March 21st, 1939.

Liquidations

General Railway Signal Co., Ltd.—Winding up voluntarily. Claims by February 8th, to the liquidator, Mr. W. R. T. Whatmore, 29, Arthur Road, Wimbledon Park, London, S.W.19.

W. G. Cannon & Sons, Ltd.—Winding up voluntarily. Liquidator, Mr. J. P. Southwell, 31, Budge Row, London, E.C.4.

Bankruptcies

H. Nutter, electrical engineer, carrying on business at 246, Yorkshire Street, Rochdale.—This debtor applied for his discharge from bankruptcy recently at the County Court Buildings, Fleece Street, Rochdale. The receiving order was made in 1927 when the liabilities were returned at £1,898. The assets, estimated by the debtor at the time of the receiving order at £181, had realised £878, the increase being due to the fact that the debtor possessed an interest in his grandfather's will of which he was not aware. That interest was sold for £625. Dividends totalling 6s. 10d. in the £ had been paid and it was anticipated that a further distribution would be made to the creditors. The debtor commenced trading on his own account in 1920. The discharge was granted, subject to six months' suspension.

It was later announced that a supplemental dividend of 11⅛d. in the £ would be payable on January 22nd, at the Official Receiver's Offices, 20, Byrom Street, Manchester.

F. A. Barratt & A. J. Barratt, manufacturers of wireless sets and components, trading as "Excel Radio Components," 53, Abingdon Street, Northampton (Application of F. A. Barratt).—Discharge suspended for four months from November 23rd, 1942.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange markets start the New Year in a cheerful frame of mind. The prospective investor, wanting to buy securities, will be less satisfied with to-day's prices than is his brother who sees the quotations for his stocks and shares standing substantially higher than they did a year ago. The value of money during 1942 steadily fell. Correspondingly, the value of stocks and shares advanced to the diminution, of course, of the income derivable from them, especially those where the interest or dividend is fixed. It is thought that few dividends are likely to be increased to any appreciable extent during the war. E.P.T. sees to it that extravagant profits cannot be retained. One of the features of the closing days of the old year was a sharp revival in the prices of Home Railway stocks. Another feature was the strength of ordinary shares in front-rank industrial companies. The New Year, as already observed, opens cheerfully, and there is every indication that the Government has no intention of departing from the policy of cheap money which has proved so successful, from the national point of view, since the outbreak of war.

The Problem of Capital

This week, there falls due for repayment nearly £80,000,000 in respect of India 3½ per cents., and next month something like £42,000,000 will be paid over through the medium of a Vesting Order applied to certain South African stocks. Every day, reductions of capital take place, involving the return of cash to the holders of securities. To such a pitch has this tendency proceeded that one of the judges in the Companies' Court asked, a few days ago, where the movement was likely to stop. He expressed a wonder as to the manner in which the money was employed. No doubt a great deal of it goes into War Bonds and other forms of war borrowing. Industrial companies are taking advantage of the abnormal cheapness of money to redeem, where they are allowed to do so, issues of debenture and similar stocks. But sometimes the process raises a query as to whether the companies which use it are fully alive to the need for keeping in hand capital that is certain to be wanted after the war.

Price Fluctuations

The principal change in this week's price-lists is the rise of 3s. in E. K. Cole 5s. shares to 18s. Electric & Musical Industries 10s. shares are better at 20s. 3d. Pye deferred 5s. shares show no change at 19s. Business in this group is active: the daily turnover of shares is of considerable volume. Amongst the higher-priced shares, Callender's are 6d. up at 76s. Something like 20,000 shares have been sold within the past few weeks, and it is a striking illustration of investment's present appetite that the price, instead of going back, should have advanced while these shares were being realised. Tube Investments are 1s. up at 91s. Murex have been changing hands up to 5 $\frac{3}{16}$. Reyrolle strengthened to 62s. 9d., at which the yield is a few pence under 4 per cent. British Aluminiums at 49s. 6d., Telephone Manufacturing at 47s., and Hopkinsons at 56s. have joined in the upward movement. Electric Constructions are up to a level £2. Cable & Wireless stocks gained a further 10s. each. Oriental Telephones at 58s. are 6d. better.

Ordinary Shares

General Electric £1 ordinary shares are offered at 85s. 9d., to pay at that price £4 1s. 6d. per cent. The company's year ends with March, and in each of the last two years, a dividend of 17½ per cent. was paid, against 20 per cent. previously. The dividend is paid once a year, in July. English Electric ordinary, which receive their dividend in March, are available at 45s. 9d., returning at that price £4 7s. 3d. per cent., assuming that the dividend of 10 per cent. is maintained. If the Brush Electrical Engineering Co. repeats its previously-paid dividend of 6 per cent., the yield at the present price of 7s., at which 2,500 shares are offered, will be a little over 4¼ per cent. Associated Electrical Industries £1 ordinary shares pay £4 2s. 6d. at 48s. 6d., on the basis of the annual dividend of 10 per cent. Thomas Tilling also pay 10 per cent. and 2,500 shares are offered at 49s. 9d., returning £4 0s. 6d. per cent. A few hundred Lancashire Dynamo ordinary shares have come in at 77s., at which price the return is £5 3s. 9d. on the 20 per cent. dividend distributed annually for some time past. Crompton Parkinson 5s. "A" ordinary shares can be bought at 25s. to return 4 per cent. on the 20 per cent. dividend. The prices given here are those at which shares are offered in the market; in some cases it may be found that the sellers will accept a little less.

Miscellaneous Matters

Apart from 1s. rise in Lancashire Electric ordinary, the list of Home electricity shares presents no changes of consequence. Amongst the overseas issues, Palestine "A" went back to 31s. and Perak Hydro-Electrics to 9s. The Government's strong hint that no official help is to be expected by tin and rubber companies whose properties have suffered from enemy action, until, at all events, after the war, has rather damped previous hopefulness. Nevertheless, people continue to take an interest, in a quiet sort

(*Continued on page* 67)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Jan. 5	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	57/6	..	4 7 0
British Power and Light	6	6	28/–	..	4 5 9
City of London	7	7	31/6	..	4 9 0
Clyde Valley	8	8	40/6	..	3 19 0
County of London	8	8	39/–	..	4 2 0
Edmundson's:					
7% Pref.	7	7	33/6xd.	..	4 3 7
Ord.	6	6	28/–	..	4 5 9
Elec. Dis. Yorkshire	9	9	43/6	..	4 3 9
Elec. Fin. and Securities	12½	12½	49/–	..	5 2 1
Elec. Supply Corporation	10	10	46/–	..	4 7 0
Isle of Thanet	2	Nil	16/–	+6d.	—
Lancs. Light and Power	7½	7½	36/6	+1/–	4 2 2
Llanelly Elec.	5½	5½	22/6	..	4 17 9
Lond. Assoc. Electric	4½	4	22/6	..	3 11 1
London Electric	6	6	27/–	−6d.	4 9 0
London Power Red. Deb.	5	5	104½	..	4 15 7
Metropolitan E.S.	8	8	40/6	..	3 19 0
Midland Counties	8	8	40/–	..	4 0 0
Mid. Elec. Power	9	9	43/6	..	4 4 9
Newcastle Elec.	7	7	30/–	..	4 13 5
North Eastern Elec. Ordinary	7	7	32/6	..	4 6 4
7% Pref.	7	7	33/6	..	4 3 7
Northampton	10	10	47/6	..	4 4 0
Notting Hill 6% Pref. (£10)	6	Nil	9¾	..	—
Northmet Power: Ordinary	7	7	38/–	..	3 13 8
6% Pref.	6	6	30/–	..	4 0 0
Richmond Elec.	6	6	25/–	..	—
Scottish Power	8	8	40/–	..	4 0 0
Southern Areas	5	5	22/6	..	4 9 0
South London	7	7	26/–	..	—
West Devon	5	5	22/6	..	4 9 0
West Glos.	4½	3½	21/6	..	3 5 2
Yorkshire Elec.	8	8	41/–	..	3 18 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	4/6	−3d.	—
Calcutta Elec.	7*	7*	31/6	..	—
Cawnpore Elec.	10	10	27/–	..	7 8 2
East African Power	7	7	29/6	..	4 15 0
Jerusalem Elec.	7	5	23/6	..	4 5 0
Kalgoorlie (10/–)	7½	5	9/6	..	5 5 3
Madras Elec.	6*	4*	22/6	..	—
Montreal Power	1½	1½	27	..	5 11 2
Palestine Elec. "A"	Nil	4*	31/–	−6d.	2 11 9
Perak Hydro-elec.	6	7	9/–	−6d.	—
Shawinigan Power	83cts.	90cts.	18½	+½	—
Tokyo Elec. 6%	6	6	21½	..	—
Victoria Falls Power	15	15	78/9	..	3 16 4
Whitehall Inv. Pref.	5	5	20/–	..	5 0 0

Company	Dividend Previous	Dividend Last	Middle Price Jan. 5	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1955–60 (Civil Defence)	—	3	99½	..	3 0 4
1955–75	5	5	115	..	4 7 0
1951–75	4½	4½	107	..	4 4 1
1963–93	3½	3½	102	..	3 8 8
1974–94	3½	3½	99	..	3 5 1
London Elec. Trans. Ltd.	2½	2½	96½	..	2 11 10
London & Home Counties 1955–75	4½	4½	108xd.	..	4 3 4
Lond. Pass. Trans.: A	4½	4½	118½	..	3 16 0
B	5	5	116½	..	4 5 10
C*	3	2⅞	55	..	5 4 8
West Midlands J.E.A. 1948–68	5	5	109	..	4 11 7
Telegraph and Telephone					
Anglo-Am. Tel.: Pref.	6	6	110½	+1	5 8 7
Def.	1½	1½	27	..	5 11 1
Anglo-Portuguese	8	8	23/–	..	6 19 4
Cable & Wireless: 5½ Pref.	5½	5½	108	+½	5 1 10
Ord.	4	4	76	+½	5 5 3
Canadian Marconi $1	Nil	4cts.	5/6	..	2 17 6
Globe Tel. & Tel.: Ord.	8¼*	5*	32/–	..	3 2 6
Pref.	6	6	27/–	..	4 9 0
Great Northern Tel.: (£10)	Nil	Nil	23	..	—
Inter. Tel. & Tel.	Nil	Nil	7	..	—
Marconi-Marine	7½	7½	31/6	..	4 15 3
Oriental Tel. Ord.	16	10	58/–	+6d.	3 9 0
Telephone Props.	6	Nil	13/3	..	—
Tele. Rentals (5/–)	10	10	10/–	..	5 0 0
Traction and Transport					
Anglo Arg. Trans.: First Pref. (£5)	Nil	Nil	5/–	+1/–	—
4% Inc.	Nil	Nil	14½	..	—
Brit. Elec. Traction: Def. Ord.	45	45	1025	+10	4 7 8
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8	10	47/3	..	4 4 6
Brazil Traction	8½	81	22½	..	—
Calcutta Trams	8	5½	19/–	..	5 15 9
Cape Elec. Trams	5	5	23/–	..	4 7 0
Lancs Transport	10	10	43/3	..	4 12 4
Mexican Light: 1st Bonds	5	5	93½	..	5 7 0
Rio 5% Bonds	5	5	102½	..	4 17 6
Southern Rly.: 5% Prefd.	5	5	75	+½	6 13 4
5% Pref.	5	5	111	+½	4 10 1
T. Tilling	10	10	49/6	+6d.	4 1 1
West Riding	10	10	37/6	..	5 6 8

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Jan. 5	Rise or Fall	Yield p.c.
Equipment and Manufacturing					£ s. d.
Aron Elec. Ord. ..	7½	10	33/6	..	5 19 4
Assoc. Elec. :					
Ord.	10	10	48/–	..	4 3 4
Pref.	8	8	39/–	..	4 2 0
AutomaticTel.&El.	12½	12½	53/–	..	4 14 4
Babcock & Wilcox	11	11	48/6	..	4 10 7
British Aluminium	10	10	49/6	+6d.	4 1 1
British Insul. Ord.	20	20	5	..	4 0 0
British Thermostat (5/–)	18½	18½	16/6	..	5 12 1
British Vac. Cleaner (5/–)	10	15	20/6	..	3 13 2
Brush Ord. (5/–)	Nil	6	6/9	..	4 12 4
Callender's ..	15	15	76/–	+6d.	3 19 0
ChlorideElec.Storage	15	15	76/3	..	3 18 9
Cole, E. K. (5/–)	7	10	18/–	+3/–	2 15 6
Consolidated Signal	17	17	95/–	..	3 11 9
Crabtree (10/–) ..	17½	17½	36/–	..	4 17 3
Crompton Parkinson Ord. (5/–) ..	30	20	24/–	..	4 3 4
E.M.I. (10/–) ..	6	6	20/3	+6d.	2 19 3
Elec. Construction	10	10	40/–	+1/–	5 0 0
Enfield Cable Ord.	12½	12½	58/6	..	4 5 7
Elect. Switchgear (10/–)	10	10	20/–	..	5 0 0
English Electric ..	10	10	45/–	..	4 9 0
Ensign Lamps(5/–)	25	25	17/6	..	7 2 10
Ericsson Tel. (5/–)	22*	20*	43/9	..	2 5 9
Ever Ready (5/–)	40	40	35/6	..	5 12 8
Falk Stadelmann	7½	7½	26/–	..	5 15 5
Ferranti Pref. ..	7	7	28/9	..	4 17 5
G.E.C. :					
Pref.	6½	6½	33/3	..	3 18 4
Ord.	20	17½	86/–	..	4 1 5
Greenwood & Batley	15	15	35/–	..	8 11 6
HallTelephone(10/–)	10	12½	22/9	..	5 10 0
Henley's (5/–) ..	20	20	23/6	..	4 5 2
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	15	56/–	+6d.	5 7 0
India Rubber Pref.	5½	5½	20/–	..	5 10 0
Intl. Combustion	32½	30	6	..	5 0 0
Johnson & Phillips	15	15	63/–	..	4 15 4
Lancashire Dynamo	20	20	76/6	..	5 1 8
Laurence,Scott(5/–)	15	12½	10/–	..	6 5 0
London Elec. Wire	7½	7½	30/–	..	5 0 0
Lucas, J.	15	15	72/6	..	4 4 0
Mather & Platt ..	10	10	46/3	..	4 6 7
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	5½	..	3 19 0
Pye Deferred (5/–)	25	25	19/–	..	6 8 2
Revo (10/–) ..	20	17½	34/6	..	5 1 5
Reyrolle	12½	12½	62/9	+9d.	3 19 7
Siemens Ord. ..	7½	7½	28/–	..	5 7 2
Smith, S. (1/–) ..	50	37½	8/3	+3d.	4 12 4
Strand Elec. (5/–)	4	7½	5/6	..	6 16 4
Switchgear & Cowans (5/–) ..	15	10	12/6	..	4 0 0
T.C.C. (10/–) ..	5	5	15/–	..	3 6 8
T.C. & M... ..	10	10	47/–	+1/–	4 5 0
Telephone Mfg.(5/–)	9	9	11/–	..	4 1 10
Thorn Elec. (5/–)	20	20	19/6	..	5 2 7
Tube Investments	23⅓	20	91/–	+1/–	4 8 0
Vactric (5/–) ..	Nil	Nil	8/6	..	—
Vickers (10/–) ..	10	10	18/–	..	5 11 1
Ward & Goldstone (5/–)	20	20	20/6	..	4 17 7
Westinghouse Brake	10	10	57/6	..	3 9 5
WalsallConduits(4/–)	55	55	41/3	..	5 6 6
West, Allen (5/–)	7½	7½	6/6	..	5 15 5

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 65)

of way, in shares of rubber and tin companies, upon the post-war prospects of the undertakings. Dollar stocks maintain their firmness. Shawinigan Power shares at 18½ have put on the fraction.

Argentina and Brazil

Brazilian Tractions were bid up a further ⅜ to 22⅝, following their last week's rise of 2; a little selling brought a reaction to 22¼. Anglo-Argentine Tramways first preference rose 1s. to 5s., the buyers arguing that this price is little more than option-money to give for a £5 share. It seems almost unfeeling to suggest that under present conditions the shares are scarcely better than gambling counters. By way of contrast, it may be observed that British Electric Traction deferred stock is up to £1,025 for £100 stock.

Too High?

The last few weeks of the old year saw sharp upward movements in the prices of Electric & Musical Industries, E. K. Cole, and shares in certain other companies connected with the radio and gramophone business. E.M.I. recently paid 6 per cent. dividend as against nothing in the previous year, and the 10s. shares have risen to 20s. 3d., giving a yield at that price of rather under 3 per cent. on the money. E. K. Cole 5s. shares received 10 per cent. for last year and at the advanced price of 18s., the return comes to 2¾ per cent. on the money. Why shares in this industry should stand at prices that bear little relation to the return offered by the dividends, it is difficult to say. The prices look too high in these, as in various other cases.

Surmise in the market sports with the suggestion that shares may be taken in hand by speculators whose operations, conducted in any market slenderly supplied, exercise a pronounced effect upon the prices. To counsel sales after such a rise is to invite possible recrimination should there be—as is quite likely to happen—a further advance. But looking at it from the longer point of view, to-day's prices would appear liberally to discount what expansion of dividend distribution by the companies concerned may be expected after the war.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—NEW SOUTH WALES.—Sydney County Council. January 28th. 440-V auxiliary power switchgear for No. 10 turbo-alternator at Bunnerong power station (Spec. 603). Battery charging equipment (Spec. 678).

March 25th. 22-kV metalclad neutral switching equipment (Spec. 610).

June 24th. Steam generating plant for Pyrmont power station, section B. (Spec. 650).

July 8th. 50,000-kW steam turbo-alternator set for Pyrmont (Spec. 651).

VICTORIA.—State Electricity Commission. March 3rd. 132- and 66-kV outdoor switchgear and accessories (Spec. 42-43/41).

COMMONWEALTH. — P.M.G.'s Department. February 9th. Transformers (Sch. C4006).

Birkenhead.—January 11th. Electricity Department. Switchgear and transformers. (December 25th.)

Bury.—January 15th. Electricity Department. Electrically driven capstan. (January 1st.)

Wolverhampton.—January 18th. West Midlands Joint Electricity Authority. High-voltage and low-voltage cables. (January 1st.)

Orders Placed

Australia.—Copies of *Tenders* of August to October last just received from Melbourne, include the following:—

COMMONWEALTH.—P.M.G.'s Department. Accepted. Sch. C.2646: Insulated wire (£8,670 plus exchange).—Reliance Electrical Wire Co., Ltd. (through High Commissioner, London). Sch. C.3558: Spare parts for telephone sets F, Mark I (£1,052).—Standard Telephones & Cables Pty., Ltd. Sch. C.3750: Accumulator plates and separators.—Exide Batteries of Australia Pty., Ltd. (£619); Tudor Accumulator Co., Ltd. (£1,067). Sch. C.3777: Components for switchboards, universal call, 10-line, lamp signalling (portable).—Standard Telephones & Cables Pty., Ltd. (£15,990). Sch. C.3248: Two-wire voice-frequency repeaters.—Standard Telephones & Cables, Ltd. (£911); Telephone Manufacturing Co., Ltd. (£9,526, plus exchange) (through High Commissioner, London). Con. 5744: Tropical instrument cords and switchboard cords (£700 plus exchange).—British Insulated Cables, Ltd. (through High Commissioner, London). Sch. C.3674: Telephone parts and accessories (£450).—Automatic Electric Co. (A'sia) Pty., Ltd. S.42/1794: Emergency power equipment for Perth G.P.O.—Ruston & Hornsby (Aust.) Pty., Ltd. (£3,736); British General Electric Co. Pty., Ltd. (£550). S.42/2015: Sydney-Melbourne, Type J channel carrier telephone system (£52,210 plus exchange) and Sch. C.3897: Start-stop telegraph machines (£6,552 plus exchange).—Standard Telephones & Cables Pty., Ltd.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Brighouse. — Houses, Rastrick; H. A. Sneezum, borough surveyor, Municipal Offices, Commercial Street, Brighouse.

Gosport. — Extensions, War Memorial Hospital; secretary to Board of Management.

Hinckley.—Houses; J. S. Featherston, surveyor, Council Offices, Station Road.

Youth training centre; Rev. E. J. Webb, Minister, Carey Baptist Church.

Huddersfield. — Sewage works; W. Jagger, borough engineer, Municipal Offices, Peel Street.

Kidderminster.—Additional office accommodation at police headquarters; J. Hawcroft, borough surveyor, Town Hall.

Kirkburton.—British Restaurant, Lepton; J. A. Haigh, surveyor, Town Hall.

Manchester.—Works extensions; J. E. Kewell, architect, 7, Market Street.

Wartime nursery, Cheetham (£2,950); Henry Green & Son, builders, Stocks Farm, Cheetham Hill Road, Cheetham, Manchester 8.

Meriden.—Houses, Balsall, for Meriden R.D.C.; H. Pickering, engineer and surveyor, Town Hall, Coleshill, near Birmingham.

Northampton.—Homes for aged and infirm, for Diocesan Board; C. E. Burton, Westminster Bank Chambers.

Club for Central Council for Recreative Physical Training; H. C. Perrin, Education Offices.

Padiham.—British Restaurant; clerk, Town Hall, Padiham, Burnley.

Salford.—Extensions to Grammar School; secretary, Board of Governors.

Sedgley.—Hostel, Upper Gornal (£3,749); E. Fletcher.

Sheffield.—Hostel for youths; W. G. Davies, city architect.

Shipley.—Hospital, Bradford Road, Board of Salt's Hospital (£100,000); E. Morley (W. J. Morley & Son), architects), 269, Swan Arcade, Bradford.

Southgate.—Restaurant, Chase Road (£3,125); borough engineer.

Tottenham.—Garages (£3,200); J. Stewart.

Warehouse additions, Tewkesbury Road; H. W. Wensell, Ltd.

Wellingborough.—Completion of housing scheme for R.D.C.; surveyor, Council Offices, 18, Oxford Street.

West Hartlepool.—Pump houses for the South Durham Steel & Iron Co., Ltd.

Worcestershire.—School kitchens at Lapal, Halesowen and Cradley; H. Rowe & Sons, county architects, 38, Foregate Street, Worcester.